

NUCLEAR SCIENCE ABSTRACTS

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TABLE OF CONTENTS

Category	Abstract	Page	Category	Abstract	Page
GENERAL	6146	777	PHYSICS	6333	801
Atomic Bombs and Warfare	6148		Astrophysics	6340	
Atomic Power	6149		Cosmic Radiation	6341	
Research Programs	6150		Crystallography and Crystal Structure	6348	
BIOLOGY AND MEDICINE	6151	777	Electrical Discharge	6352	
Radiation Effects	6154		Electrons	6362	
Radiation Hazards and Protection	6166		Gases	6369	
Radiotherapy	6167		Instruments	6372	
Toxicology Studies	6171		Isotopes	6384	
Tracer Applications	6173		Isotope Separation	6390	
CHEMISTRY	6177	780	Mass Spectrography	6395	
Analytical Procedures	6193		Mathematics	6397	
Crystallography and Crystal Structure	6204		Measuring Instruments and Techniques	6400	
Deuterium and Deuterium Compounds	6205		Mesons	6426	
Fluorine and Fluorine Compounds	6209		Microwaves	6437	
Graphite	6214		Molecular Properties	6438	
Molecular Structure	6218		Neutrons	6439	
Radiation Chemistry	6221		Nuclear Physics	6444	
Radiation Effects	6224		Nuclear Properties	6448	
Rare Earths and Rare-earth Compounds	6225		Nuclear Reactors	6474	
Separation Procedures	6226		Nuclear Transformation	6484	
Syntheses	6235		Particle Accelerators	6493	
Uranium and Uranium Compounds	6236		Radiation Absorption and Scattering	6500	
ENGINEERING	6240	788	Radiation Effects	6507	
Heat Transfer and Fluid Flow	6243		Radioactivity	6511	
Materials Testing	6254		Rare Earths and Rare-earth Compounds	6541	
Radiography	6255		Shielding	6543	
Tracer Applications	6256		Spectroscopy	6544	
MINERALOGY, METALLURGY, AND CERAMICS	6258	791	Theoretical Physics	6546	
Ceramics and Refractories	6260		Tracer Applications	6554	
Corrosion	6261		Uranium and Uranium Compounds	6555	
Geology and Mineralogy	6268				
Metals and Metallurgy	6279				
			AUTHOR INDEX		INDEX-1
			NUMERICAL INDEX OF REPORTS		INDEX-7

GENERAL

6146 TID-4000

Technical Information Service, AEC.
CUMULATED NUMERICAL LIST OF AVAILABLE
UNCLASSIFIED U. S. ATOMIC ENERGY COMMISSION
REPORTS. Feb. 1955. 204p.

6147

ATOMIC ENERGY IN INDUSTRY. III. MINUTES OF 3RD
CONFERENCE [HELD] OCTOBER 13-15, 1954 [AT] NEW
YORK CITY. New York, National Industrial Conference
Board, Inc., 1955. 412p. \$15.00.

ATOMIC BOMBS AND WARFARE

6148

THE EFFECTS OF HIGH-YIELD NUCLEAR EXPLOSIONS.
Statement by Lewis L. Strauss and a Report by the U. S.
Atomic Energy Commission. Washington, U. S. Government
Printing Office, Feb. 1955. 19p. \$0.10.

A basic, general discussion is given on the effects of nu-
clear explosions, with particular attention being given to
fallout and the protection from fallout. (B.J.H.)

ATOMIC POWER

6149

NEW USE FOR NUCLEAR ENERGY. *Chem. Eng.* 62, 132,
134(1955) Aug.

It is suggested that the chemical process industries can
capitalize on nuclear energy by using nuclear reactors as
a source of process heat. Engineering problems and cost
factors are discussed briefly. (C.H.)

RESEARCH PROGRAMS

6150 NRL-4557

Naval Research Lab., Washington, D. C.
FIELD FACILITIES FOR ENVIRONMENTAL RESEARCH
OF THE NAVAL RESEARCH LABORATORY. Interim
Report. Allen L. Alexander and B. W. Forgeson. May 24,
1955. 43p. Project Nos. NR 603-020, NE 120-901-4, and
NE 111-273.

For its tropical studies the Naval Research Laboratory
operates the Tropical Exposure Site and the Corrosion
Laboratory in the Panama Canal Zone. The Corrosion
Laboratory is maintained with cooperation of the Panama
Canal Company and the Engineer Research and Develop-
ment Laboratories, Fort Belvoir, Virginia. The facilities
include a chemical laboratory, physical testing laboratory,
mycology laboratory, and auxiliary equipment such as
shops, photographic darkroom, and extensive protected
areas for field exposures. The latter consists of piers for
fresh water, sea water, and alternate sea water-air

exposures. Atmospheric racks are located in salt laden
and clear atmospheres and facilities are available for
several types of jungle exposure. These tropical testing
facilities are available to other government agencies
and/or their contractors under most circumstances.
(auth)

BIOLOGY AND MEDICINE

6151 AERE-Lib/Trans-502

FURTHER STUDIES ON THE THROMBOCYTES UNDER
THE ELECTRON MICROSCOPE. H. Braunsteiner.
Translated by A. H. Gillieson from *Acta Haematol.* 3,
170-3(1950). 3p.

6152 AERE-Lib/Trans-503

THROMBOCYTES AND FIBRIN-FORMATION UNDER THE
ELECTRON MICROSCOPE. H. Braunsteiner and H.
Febvre. Translated by A. H. Gillieson from *Acta Haematol.*
3, 174-8(1950). 3p.

6153

SYMPOSIUM ON GENETIC RECOMBINATION GIVEN AT
RESEARCH CONFERENCE FOR BIOLOGY AND MEDICINE
OF THE ATOMIC ENERGY COMMISSION: SPONSORED BY
THE BIOLOGY DIVISION, OAK RIDGE NATIONAL LABO-
RATORY. *J. Cellular Comp. Physiol.* 45, Suppl 2, May
1955. 321p.

RADIATION EFFECTS

6154 NP-5730

Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 16. July 15, 1955.
110p. Contract AF-33(038)-27353.

Progress is reported in studies of the effects of several
organic sulfur-containing compounds, adrenergic blocking
agents, and purine and pyrimidine derivatives on the
mortality of x-irradiated mice and rats; the influence of x
irradiation on the metabolism of borneol in mice and rats;
the effects of decreased barometric pressure on the
mortality of rats exposed to whole-body x irradiation; the
effect of starvation and of 800 r of whole-body x irradiation
on the free amino acid content of rat plasma; design of an
apparatus for simultaneously measuring heat production,
rectal temperature, oxygen consumption, and carbon
dioxide production in rats and mice; changes in body weight,
spleen and thymus weight, and survival time in rats
exposed to various daily doses of total-body irradiation;
and the effects of intermittent, low-level x irradiation
on 5-nucleotidase and adenosine triphosphatase activities
of the spleen and thymus gland in rats. (For preceding
period see NP-5645.) (C.H.)

6155 UCSF-11

California. Univ., San Francisco. School of Medicine.
Radiological Lab.

RADIOLOGICAL LABORATORY SEMI-ANNUAL REPORT
FOR PERIOD ENDING JUNE 30, 1955. July 1955. 36p.
Contract AT-11-1-GEN-10, Project No. 2.

Physics. Modifications in the 70-Mev synchrotron to insure reproducible and essentially continuous operations are reported. X-ray dosage measurements in a Presswood phantom are reported. Biology. Data are presented from a statistical analysis of the effect of age at time of exposure on LD₅₀ data for mice; the late effects of whole-body irradiation in mice; direct and indirect effects of x radiation on the testis of the rat; the effects of incubation time on macrocolony formation after x irradiation of microorganisms; the combined effects of endogeneous respiration and cell concentration on the killing of microorganisms by x radiation; and the current status of patients treated for hyperthyroidism with radiiodine. (For preceding period see UCSF-10.) (C.H.)

6156 USNRDL-TR-46

Naval Radiological Defense Lab., San Francisco.

EFFECTS OF SPECTRAL DISTRIBUTION OR RADIANT ENERGY ON CUTANEOUS BURN PRODUCTION IN MAN AND THE RAT. E. L. Alpen, C. P. Butler, S. B. Martin, and A. K. Davis. Apr. 25, 1955. 26p. Project No. NM 006-015. (AFSWP-737)

The significance of the optical properties of skin is discussed and the property of the high transmission of skin in the region 0.7 to 1.0 μ is presented. (auth)

6157

GENETICAL EFFECTS OF RADIATION FROM PRODUCTS OF NUCLEAR EXPLOSIONS. J. B. S. Haldane (Univ. Coll., London). *Nature* 176, 115(1955) July 16.

The serious nature of genetical effects of radiation is argued. Upper and lower limits of radiation-induced human mortality are estimated. (B.J.H.)

6158

A FACTOR INFLUENCING THE SIGNIFICANCE OF RADIATION MORTALITY EXPERIMENTS. Antolin Raventos (Univ. Hospital, Philadelphia). *Brit. J. Radiol.* 28, 410-14 (1955) Aug.

The distribution of post-irradiation mortality among apparently identical cages of mice was studied. It was found that the mortality of any single cage may be strongly influenced by a cage effect, which disappears when the mice are shuffled, each to a different cage every 24 hours. As a result of cage effect, the mortality of any single cage or small number of cages is a significantly less reliable estimate of the mortality of the entire population that can be accounted for by random variation alone. Therefore, a substantial difference in mortality between two experimental groups, although statistically significant by conventional tests, may be spurious if the groups are housed separately. Possible causes of cage effect are discussed, but no investigation of the causes was made. Cage effect can probably be avoided by caging each mouse individually, and this was found not to alter radiation sequelae materially. It was shown that valid mortality comparisons can be made with multiple animal caging if each cage originally contains an equal number of animals from each of the groups whose mortalities are to be compared. (auth)

6159

ACTION OF γ RAYS ON CREPIS ZACINTHA L. BABC: INFLUENCE OF THE INTENSITY OF IRRADIATION ON THE RATE OF CELLULAR FATALITY. Andre Bilquez. *Compt. rend.* 241, 327-9(1955) July 18. (In French)

Some seeds of *Crepis Zacintha L. Babc.* were submitted to different intensities of Co⁶⁰ γ radiation, and, after irradiation, were allowed to grow. Data on the number of abnormal cells produced in this way are tabulated. It is concluded that cellular lethality is greatly affected by radiation intensity and that allowing seeds to germinate only after a year has elapsed since irradiation does not affect lethality. (B.J.H.)

6160

METABOLISM AND CHROMOSOME-BREAK REJOINING. Sheldon Wolff and Henry E. Luippold (Oak Ridge National Lab., Tenn.). *Science* 122, 231-2(1955) Aug. 5.

Factors affecting the rejoining of chromosomes of *Vicia* following radioinduced breakage were investigated. Data are tabulated on the effect of respiratory inhibitors and 2,4-dinitrophenol on chromosome rejoining. (C.H.)

6161

EFFECT OF X-IRRADIATION ON CECAL FLORA OF THE RAT. Emily J. Bell, John G. Coniglio, and Granville W. Hudson (Vanderbilt Univ., Nashville). *Proc. Soc. Exptl. Biol. Med.* 89, 404-6(1955) July.

The effect of total-body x irradiation on the cecal flora of rats has been studied. Numbers of lactobacilli, coliforms, and azide-resistant organisms in rats fasted 24 hours before and after irradiation were compared to those in paired control rats fasted for the same 48-hour period. The normally predominant lactobacilli decreased in number while the coliforms and azide-resistant bacteria increased. A fasting period of 48 hours elicited no proportional change in bacterial types when the counts were compared with those of normal fed rats. Irradiation itself was responsible, at least in part, for the observed changes. (auth)

6162

RADIATION STUDIES ON THE MONKEY EYE. I. EFFECTS OF GAMMA RADIATION ON THE RETINA. David V. L. Brown, Paul A. Cibus, and John E. Pickering (School of Aviation Medicine, Randolph Field, Texas). *Arch. Ophthalmol.* 54, 249-56(1955) Aug.

Co⁶⁰ gamma radiation of 10,000 r was delivered at a rate of 1000 \pm 50 r/min to the head of 16 monkeys, to the body of a second group of 16 monkeys, and to the whole body of a third group of 16 monkeys. Five monkeys were employed as controls. The animals were killed by decapitation at intervals of 2, 4, 8, 12, 24, 48, 72, and 96 hours following irradiation. Ocular abnormalities were found in those animals who received radiation directly to the eyes. Changes seen in the eyes of animals exposed to head radiation were essentially similar to those changes seen in the group receiving whole-body radiation. Clinical manifestations consisted of severe iridocyclitis, retinal edema, papilledema, severe hypotony, and, in a few cases, punctate and flame-shaped retinal hemorrhages. Histological abnormalities consisted chiefly of pyknosis of the rod nuclei, and degenerative sequelae in the outer nuclear and bacillary layers. Both clinical and histological alterations developed in a definite time pattern. (auth)

6163

EFFECT OF RADIOPHOSPHORUS ON GERMINATION AND GROWTH OF OATS IN RELATION TO CONDITION OF

PHOSPHATE SUPPLY. A. G. Shestakov, G. F. Ivanova, and N. I. Shmel'kova (Moscow Agricultural Academy). *Doklady Akad. Nauk S.S.S.R.* 102, 395-7(1955) May 11. (In Russian)

6164

ON DIRECT AND INDIRECT EFFECTS OF IONIZING RADIATION ON BIOLOGICAL OBJECTS. Ya. L. Shekhtman (Inst. of Biophysics, Academy of Sciences, U.S.S.R.). *Doklady Akad. Nauk S.S.S.R.* 102, 511-14(1955) May 21.

The effects of low temperature (-120°C) and atmosphere (air and N_2) on root growth of wheat sprouts exposed to 32,000 r of 160-kv x rays were measured and interpreted in terms of direct and indirect radiation effects. (G.Y.)

6165

ON THE REACTION OF PLANTS TO THE RADIATION EFFECTS OF P^{32} IN THE SECOND GENERATION. A. G. Shestakov, G. F. Ivanova, and N. I. Shmel'kova (Moscow Agricultural Academy). *Doklady Akad. Nauk S.S.S.R.* 102, 641-3(1955) May 21. (In Russian)

RADIATION HAZARDS AND PROTECTION

6166

ENHANCEMENT OF RADIOBIOLOGICAL EFFECT BY MALONIC AND MALEIC ACIDS. M. Kiga, Y. Ando, and H. Koike (Showa Medical School, Tokyo). *Science* 122, 331-2(1955) Aug. 19.

Data are presented from studies on the effects of malonic and maleic acids on the radiosensitivity of yeast. (C.H.)

RADIOTHERAPY

6167 AERE-Lib/Trans-537

A NEW THERAPEUTIC PRINCIPLE OF APPLICATION OF RADIO-ACTIVE ISOTOPES IN CLOSED ELASTIC APPLICATORS. J. Becker and K. E. Scheer. Translated by F. Hudsell from *Strahlentherapie* 90, 546-52(1953). 5p. (AERE-Trans-11/3/5/537)

A method for the intracavitary application of radioactive cobalt is described in which the activity is firmly bound in small spheres which are maintained in suspension in an inactive liquid. A concentration of the activity at any required position can be obtained by altering the specific gravity of the liquid. (auth)

6168

RADIOACTIVE ISOTOPE IN KLINIK UND FORSCHUNG—VORTAGE AM GASTEINER INTERNATIONALEN SYMPOSION 1954 (Radioisotopes in Clinic and Research—Lectures at the Gastein International Symposium, 1954). K. Fellinger and H. Vetter, eds. Berlin, Urban und Schwarzenberg, 1955. 244p. (In German)

6169

NEW TECHNIC FOR INTRACAVITARY USE OF Co^{60} . William C. Shoemaker and Arthur W. Wase (Hahnemann Medical Coll. and Hospital, Philadelphia). *Proc. Soc. Exptl. Biol. Med.* 89, 409-10(1955) July.

A new concept is described for the intracavitary use of radiocobalt employing an agent to precipitate the cobalt directly on the mucosa of the urinary bladder together with dispersing agent to enhance penetration of the radiocobalt into the tissues. Results in the use of this technic in dogs

are presented. When 8-oxyquinoline solution was instilled into the bladder prior to the radiocobalt, there was an increase and prolongation of measureable radioactivity. When both 8-oxyquinoline and sorbitol were used this effect was further augmented. (auth)

6170

THE APPLICATION OF AUTOMATIC COMPUTING MACHINES TO RADIATION TREATMENT PLANNING. K. C. Tsien (Memorial Center for Cancer and Allied Diseases, New York). *Brit. J. Radiol.* 28, 432-9(1955) Aug.

A method is described for determining x radiation dose distribution which employs punched cards, sorting, and tabulating machines instead of isodose charts. (auth)

TOXICOLOGY STUDIES

6171 NP-5667

Industrial Hygiene Foundation [of America, Inc., Pittsburgh] and Mellon Inst. [of Industrial Research], Pittsburgh.

REVIEW OF LITERATURE ON TOXICITY, PHYSIOLOGICAL EFFECTS AND MEDICAL USES OF ZIRCONIUM AND ITS COMPOUNDS. July 1954. 15p.

A summary is presented of data obtained from a review of the literature covering the toxicity, physiological effects, and medical uses of Zr and its compounds. 62 references. (C.H.)

6172

Ca EDTA AND THE EXCRETION OF PLUTONIUM. H. Foreman, T. T. Trujillo, O. Johnson, and C. Finnegan (Los Alamos Scientific Lab., N. Mex.). *Proc. Soc. Exptl. Biol. Med.* 89, 339-42(1955) July.

A comparison of Ca EDTA and Zr citrate for the therapy of acute Pu poisoning was made in which it was found that Ca EDTA brought forth greater Pu excretion than did the Zr citrate. The use of the latter agent resulted in lower Pu skeletal content than occurred in the Ca EDTA treated animals. Combined Ca EDTA and Zr citrate treatment produced the same results as Zr citrate alone. Ca EDTA administered long after Pu was deposited in bone did remove Pu from the skeleton but this is a slow process. A comparison of the regimen of Na EDTA and Ca EDTA with one using Ca EDTA alone in acute Pu exposures showed no advantage to either. Ca EDTA did not influence passage of Pu across the lung alveolar membrane. Ca EDTA did not influence the rate of mobilization of Pu from an intramuscular site. Ca EDTA did not influence the rate of absorption of Pu from the gastrointestinal tract. (auth)

TRACER APPLICATIONS

6173 BNL-2407

Brookhaven National Lab., Upton, N. Y. and Harvard Univ., Boston. Medical School. Biophysical Lab. THE METABOLISM OF GLYCERIDE—GLYCEROL. Lewis I. Gidez and Manfred L. Karnovsky. [1955]. 49p.

6174 HW-33681

Hanford Atomic Products Operation, Richland, Wash. THE UPTAKE OF IODINE BY HIGHER PLANTS. A. A. Selders and J. H. Rediske. Sept. 30, 1954. 16p. Contract W-31-109-Eng-52.

Results of tracer studies on the uptake of iodine by plants

from soil and nutrient solution are reported as a function of pH, plant species, and iodine concentration. Iodine is readily absorbed from both soil and nutrient solution. The absorption is approximately four times greater at pH 4 than at pH 7. The four plant species tested differed in their ability to concentrate the iodine, but all were within a tenfold variation. Instead of lowering the percentage of radioiodine absorbed, the addition of carrier increases the percentage of iodine that is absorbed into the plant. (auth)

6175

THYROID UPTAKE OF RADIOACTIVE IODINE IN THE DOG; EFFECT OF DIET, HYPOPHYSECTOMY, AND TSH. Donald S. Fredrickson, William F. Ganong, and David M. Hume (Harvard Medical School and Surgical Service, Peter Bent Brigham Hospital, Boston). *Proc. Soc. Exptl. Biol. Med.* 89, 416-19(1955) July.

A scintillation counter adapted to the determination of thyroid I^{131} uptakes in the unanesthetized dog is described. The dog was shown to have a relatively slow rate of accumulation of I^{131} by the thyroid, but a total uptake of the same order of magnitude as man and the rabbit if the dog was maintained on a dietary intake of 70 μ g of iodine or less per day. Hypophysectomy markedly depressed the thyroidal uptake and blood I^{131} clearance rate, and TSH administration elevated the rate of uptake and release. (auth)

6176

METABOLISM OF LANTHANUM AND YTTRIUM CHELATES. Hiram E. Hart, Joseph Greenberg, Ruth Lewin, Herta Spencer, K. G. Stern, and Daniel Laszlo (Montefiore Hospital, New York). *J. Lab. Clin. Med.* 46, 182-92(1955) Aug.

The metabolism of lanthanum and yttrium administered intravenously in ionized form or as chelates of ethylenediaminetetraacetic acid (EDTA) and nitrilotriacetic acid (NTA) to human subjects and experimental animals was studied. La^{140} and Y^{90} were used as tracers. It was found that the plasma content, urinary excretion, and tissue uptake of these metals depended upon the compound administered. (auth)

CHEMISTRY

6177 BNL-353

Brookhaven National Lab., Upton, N. Y.
ESTIMATES OF THE SOLUBILITY AND DIFFUSION CONSTANT OF XENON IN LIQUID BISMUTH. W. G. McMillan. June 1955. 12p. (LMFR-12)

Expressions have been obtained for calculating the solubility, diffusion, energy of solution, and adsorption of $Xe(g)$ in $Bi(l)$. The rate of removal of Xe from the LMFR fuel may be estimated from its physical properties. (C.W.H.)

6178 ISC-566

Ames Lab., Ames, Iowa.
SOME ISOTOPIC EXCHANGE REACTIONS OF MANGANESE. James A. Happe and Don S. Martin, Jr. Jan. 27, 1955. 37p. Contract W-7405-eng-82.

Radioactive Mn has been used in investigating several isotopic exchange reactions of Mn. A rapid partial exchange has been found to occur between Mn^{2+} and MnO_2 prepared in excess Mn^{2+} . It was indicated that only Mn on the surface of MnO_2 particles takes part in the exchange. A complete and rapid exchange has also been found to

occur during the course of the Guyard reaction. A rapid Mn^{2+} - Mn^{4+} exchange has been proposed as a probable mechanism. It is believed that slow exchange observed between Mn^{2+} and MnO_4^- is not a true exchange but is due to a carrying of active Mn by tetraphenylarsonium permanganate precipitates. A spectrophotometric examination of Mn^{2+} - MnO_4^- mixtures has provided an indication as to the mechanism of the initial reaction between Mn^{2+} and MnO_4^- in acid solution. (auth)

6179 LA-1926UNM

New Mexico. Univ., Albuquerque.
THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. III. p-CYANO BENZYL IODIDE. Milton Kahn and J. L. Riebsomer. June 1955. 8p. For Los Alamos Scientific Lab. Subcontract under [W-7405-eng-36].

A measurable exchange has been observed in methanol and ethanol between the iodide atom in p-cyanobenzyl iodide and the iodide ion in potassium iodide. The exchange reaction was investigated over a temperature range from 0 to 30.9° C. The rate laws for the exchange are $R(\text{methanol}) = 5.16 \times 10^{11} (p\text{-CNB}_2\text{I}) (\text{KI}) \exp(-15,900/RT)$ $R(\text{ethanol}) = 9.25 \times 10^{11} (p\text{-CNB}_2\text{I}) (\text{KI}) \exp(-15,600/RT)$ where the units of R are moles/liter/min. (auth)

6180 NP-5712

Library of Congress. Technical Information Div., Washington, D. C.

BORON, BORON HYDRIDES, AND RELATED SUBSTANCES: A BIBLIOGRAPHY. Mary E. Schroder and Thomas C. Goodwin, Jr. June 1955. 188p.

The results of a search of published literature for the period from 1950 through 1952 are presented in bibliographic form. Material is included on the preparation, properties, reactions, and uses of boron and boron compounds. 514 references. (C.W.H.)

6181 NP-5728

Denver. Univ. Denver Research Inst.
DEVELOPMENT OF "CHAIN TYPE" POLYPHENYL COMPOUNDS FOR USE AS HIGH TEMPERATURE LUBRICANTS AND HYDRAULIC FLUIDS. LITERATURE SURVEY. Quarterly Progress No. 1 [for] April 15-July 15, 1955 [on] Project No. 116. July 15, 1955. 76p. Project No. 5-(7-73400). Contract AF 33(616)-2939.

A literature survey was conducted in the field of biphenyl, terphenyl and other "chain type" polyphenyl compounds and their derivatives with the aim of disclosing compounds feasible as high-temperature lubricants and hydraulic fluids in the temperature range -56 to 700°F. The results and the evaluation of this survey are presented as Phase I of this program. Correlations between chemical structure and physical properties are summarized and a series of potential compounds recommended for synthesis and closer investigation. (auth)

6182 RDB(C)/TN-131

Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THE OXIDATION OF LITHIUM. REPORT OF PROGRESS TO APRIL 5, 1955. C. Tyzack and P. B. Longton. June 15, 1955. 10p. (XMPDC/P5)

The reaction between dry oxygen and lithium at constant pressure over the range 0 to 760 mm Hg and at temperatures from 25 to 900°C has been investigated. The variation of ignition temperature with pressure has been investigated, and shown to be pressure dependent. (auth)

6183 RMO-2007

International Minerals and Chemical Corp., Chicago.
NITRIC ACID DIGESTION OF LEACHED ZONE. William R. Bowen, Robert F. McCullough, and Judson G. Brown. Mar. 31, 1952. Decl. Apr. 13, 1955. 36p. Contract AT(49-1)-538.

Preliminary laboratory data are presented on the development of a procedure whereby HNO_3 may be used to solubilize U_3O_8 , P_2O_5 , and Al_2O_3 from minus 200 mesh leached zone material. Research was undertaken to establish optimum digestion conditions using HNO_3 as an alternate process to the use of H_2SO_4 for digesting leached zone. (J.E.D.)

6184 RMO-2034

International Minerals and Chemical Corp., Chicago.
LEACHED ZONE—PHOSPHATE RECOVERY. John H. Gross, J. B. Adams, and Roger Bart. Feb. 28, 1955. 20p. Contract AT(49-1)-545. (IMCC-2205)

Phosphates can be recovered from sulfuric acid digestion solutions after crystallization of ammonium alum and extraction of uranium. The method reported involves precipitating part of the phosphate as complex phosphates of iron, aluminum, and ammonium by addition of ammonia to bring the pH to about 4.5. This step is followed by filtration and crystallization of ammonium sulfate and phosphate from the solution, or, alternatively, by evaporation of water from the whole ammoniation slurry to deposit the ammonium salts mixed with the metal phosphates. (auth)

6185 TID-3070

Technical Information Service, AEC.
NUCLEAR SCIENCE: A BIBLIOGRAPHY OF SELECTED UNCLASSIFIED LITERATURE. Apr. 1955. 116p.

A total of 1517 references are listed in this compilation. These include selected non-published United States Atomic Energy Commission reports and published articles in technical books and journals. An author and a report number index with availability information are also included. (auth)

6186 TID-3075

Technical Information Service, AEC.
NUCLEAR TECHNOLOGY: A SELECTED LIST OF REFERENCES. Simone B. Schwind, comp. Apr. 1955. 72p.

The bibliography contains 922 selected references to AEC reports and to the open literature relative to industrial applications of atomic energy. An author and a report number index with availability information are also included. (auth)

6187 TID-5276

[Atomic Energy Commission, Washington, D. C.]
CHEMICAL PROCESSING AND EQUIPMENT. SELECTED REFERENCE MATERIAL. UNITED STATES ATOMIC ENERGY PROGRAM. 1955. 312p.

The facilities, equipment, and process used for the recovery of U from spent reactor fuel elements at the Arco Plant are described. Also, the application, description, and operation of equipment for hot laboratories and discussion of building structure and layout of hot laboratories are presented. (C.W.H.)

6188 WADC-TR-55-221

Hooker Electrochemical Co., Niagara Falls, N. Y.
INVESTIGATION OF CONDENSATION TYPE ELASTOMERS. George C. Schweiker, Russell R. White, and Rudolph N. Deleo. PROJECT NO. 7340. [ANNUAL RE-

PORT FOR JUNE 1, 1954 TO JUNE 1, 1955]. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. May 1955. 55p. Contract AF33(616)-2421. This report includes: Purdue Univ., Lafayette, Ind. FLUORINE-CONTAINING MONOMERS FOR CONDENSATION POLYMERS. SUMMARY PROGRESS REPORT. Earl T. McBee and Carleton W. Roberts. Apr. 1955. Subcontract under AF33(616)-2421.

Various fluorine- and sulfur-containing difunctional compounds have been prepared and high molecular weight polyesters have been synthesized. The linear polyesters made from fluorine-containing glycols exhibit rubber-like properties and are not brittle at low temperatures, in some cases. When fluorine is contained in these polyesters in adequate amounts, they are resistant to hydrocarbon solvents. (auth)

6189 AEC-tr-2197

THE REACTION BETWEEN CALCIUM HYDRIDE AND WATER. Haakon Flood. Translated from *Kgl. Horskø Videnskab. Selskabs, Forh.* 7, No. 19, 66-9(1935). 5p.

A complete discussion is given of the reaction between calcium hydride and water under several conditions. The speed of gas evolution was observed as a function of temperature, and the rate of reaction was observed as a function of the CaH_2 vapor pressure. Data are tabulated. (B.J.H.)

6190 NRL-Trans-504

THE PROCESS OF ELECTROCHEMICAL LIBERATION OF OXYGEN ON NICKEL. (Protsess Elektrokhimicheskogo Vydeleniya Kisloroda na Nিকেle). L. M. Elina, T. I. Borisova, and Ts. I. Zalkind. Translated by A. Pingell from *Zhur. Fiz. Khim.* 28, 785-96(1954). 21p.

The process of oxygen liberation proceeds on the electrode surface covered by a layer of Ni_2O_3 , due to formation and disintegration of the highest oxygen-nickel compound. With small current densities, the rate of oxygen liberation is controlled by the rate of disintegration of the highest oxygen compound, and with high densities by the rate of its formation during discharge of the CH^- ions. The experimental results of investigation of the mechanism and kinetics of oxygen liberation on the nickel electrode in alkali are in full agreement with the fundamental position of the chemical (catalytic) theory of electrode processes concerning the decisive role of surface oxygen compounds in anodic electrochemical reactions. (auth)

6191 TT-546

ENERGY TRANSFER OF SENSITIZED FLUORESCENCE OF MIXTURES OF VAPOURS OF ORGANIC COMPOUNDS. (Perenos Energii Pri Sensibilizirovannoi Fluorestsentsii Smeseli Parov Organicheskikh Soedinenii). A. N. Terenin and A. V. Kariakin. Translated by G. Belkov from *Doklady Akad. Nauk S.S.S.R.* 96, 269-72(1954). 9p.

6192

STRUCTURE AND PROPERTIES OF BERYLLIUM BORIDES. L. Ya. Markovskii, Yu. D. Kondrashev, and G. V. Kaputovskaya (State Inst. of Applied Chemistry). *Zhur. Obshchei Khim.* 25, 1045-52(1955) June. (In Russian)

ANALYTICAL PROCEDURES**6193 AD-49370**

Arkansas. Univ., Fayetteville. Engineering Experiment Station.

A PROPOSAL FOR THE DETECTION OF TRACE

AMOUNTS OF VAPORS IN GAS MISTURES. M. K. Testerman. [1954?]. 9p. Contract AF33(616)-15.

A technique utilizing the mass spectrometer in the determination of the concentration of vapors which are present in tracer amounts in a gas mixture is described. Several modifications are outlined for the RF mass spectrometer which will increase its sensitivity in this type of analysis. (C.W.H.)

6194 IDO-14301

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

URANIUM DETERMINATION BY THE ISOTOPE DILUTION TECHNIQUE. W. E. Duffy and F. H. Tingey. June 21, 1955. 21p. Contract AT(10-1)-205.

The successful use of the isotope dilution technique, employing a thermal emission mass spectrometer, is described in connection with uranium analyses at the Idaho Chemical Processing Plant. Data from process and control samples are analyzed and compared statistically. (auth)

6195 SO-2522

General Electric Co. Research Lab., Schenectady, N. Y. ZIRCONIUM ALLOYS FOR NUCLEAR PROPERTIES. SPECTROGRAPHIC DETERMINATION OF ALUMINUM IN ZIRCONIUM. L. B. Bronk and R. S. McDonald. July 1955. 8p. Contract W-31-109-Eng-52. (55-RL-1353)

An emission spectrographic method using the solution-spark, rotating disk electrode technique has been developed to determine aluminum present in Zr-Al alloys in the range of 0.1 to 2% aluminum. (auth)

6196 WCLP-TN-54-235

Wright Air Development Center. Power Plant Lab., Wright-Patterson AFB, Ohio.

A RAPID VOLUMETRIC PROCEDURE FOR THE DETERMINATION OF HYDROFLUORIC ACID IN FUMING NITRIC ACID. Hugh E. Malone and Edward L. Harris. Dec. 1954. 10p. Project No. 3055-30196. (AD-51655)

This determination of HF is based upon the titration of F^- with $AlCl_3$ as reagent ($Al^{3+} + 6F^- = AlF_6^{3-}$). The acid reaction produced by the hydrolysis of excess $AlCl_3$ ($AlCl_3 + 3HOH = 3HCl + Al(OH)_3$) with methyl red as indicator, provides a means of determining the amount of $AlCl_3$ required to form the complex, AlF_6^{3-} . Nitrates, chlorides, and sulfates do not interfere with the determination. (C.W.H.)

6197

A STUDY OF THE ACCURACY OBTAINED IN VAN SLYKE COMBUSTION AND RADIOASSAY OF CARBON-14 COMPOUNDS. Clair J. Collins and Gus A. Ropp (Oak Ridge National Lab., Tenn.). *J. Am. Chem. Soc.* **77**, 4160-1(1955) Aug. 5.

It is demonstrated that with carefully controlled wet combustion and radioassay with the vibrating reed electrometer the assays are sufficiently accurate for evaluating isotope fractionation in reactions of C^{14} compounds. The relative specific activity of a C^{14} compound can be measured within approximately $\pm 0.5\%$ or better as compared with some standard. (C.W.H.)

6198

COLORIMETRIC ESTIMATION OF THORIUM WITH NITROSO R-SALT. K. V. Subbarama Rao and S. V. Raghava

Rao (Andhra Univ., Waltair, India). *J. Sci. Ind. Research (India)* **14B**, 278-81(1955) June.

A colorimetric method is described for the determination of Th employing nitroso R-salt as the reagent. The method is sensitive and quantities as small as 1γ of ThO_2 can be estimated. (auth)

6199

SPECTROPHOTOMETRIC DETERMINATION OF TRACES OF TITANIUM IN URANYL NITRATE. R. Fernandez Cellini and T. Baruecas Rodriguez. *Anales real soc. españ. fís. y quim. (Madrid)* Ser. B **51**, 409-16(1955) June. (In Spanish)

6200

HOW TO MINIMIZE ERRORS IN NEUTRON ACTIVATION ANALYSIS. Robert C. Plumb and John E. Lewis (Aluminum Co. of America, New Kensington, Penna.). *Nucleonics* **13**, No. 8, 42-6(1955) Aug.

A general discussion is given of the limitations to neutron activation analysis. Particular points discussed are errors in activity measurements, incomplete chemical separations, radioactive contamination in the carrier, and errors in activation. Methods of minimizing these errors are suggested. (B.J.H.)

6201

COLORIMETRIC DETERMINATION OF ZIRCONIUM WITH ALIZARIN-S. O. Gübeli and A. Jacob. *Helv. Chim. Acta.* **38**, 1026-32(1955) June. (In German)

6202

DETERMINATION OF THORIUM WITH ORGANIC REAGENTS: DIFFERENT METHODS USING p-AMINO-SALICYLIC ACID. Sachindra Kumar Datta and Gurupada Banerjee (Darjeeling Government Coll., India). *Anal. Chim. Acta* **13**, 23-7(1955) July.

p-Aminosalicylic acid (PAS) can be successfully utilized as a reagent for gravimetric and volumetric determination of thorium. A quantitative precipitate of thorium is obtained by adding a hot 2% solution of PAS, in the presence of a little ammonium acetate at a pH range between 4 and 5.6. The thorium salt filters, washes and ignites readily. Thorium content of the salt can be determined directly by ignition to thoria, and indirectly by the quantitative bromination of the organic ligand with bromide-bromate mixture or by iodination with iodine monochloride in glacial acetic acid solution at $0^\circ C$. (auth)

6203

THE ESTIMATION OF TRACE AMOUNTS OF BARIUM OR STRONTIUM IN BIOLOGICAL MATERIAL BY ACTIVATION ANALYSIS. G. E. Harrison and W. H. A. Raymond (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* **1**, 290-8(1955) June.

A neutron activation method is described for the estimation of barium or strontium in biological materials which is not disturbed by the presence of a large excess of calcium. The method is a comparative one in which a weighed amount of a pure barium or strontium salt receives the same neutron irradiation in a nuclear pile as a weighed aliquot from the unknown specimen. Following a chemical separation, the activity of the barium or strontium fraction from the unknown is compared with that from the appropriate standard. The error of the method is estimated to be about 5% in specimens containing from 1 to $50 \mu g$ of either element. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

6204 ANL-5433

Argonne National Lab., Lemont, Ill.

DIFFUSION OF CARBON ATOMS IN NATURAL GRAPHITE CRYSTALS. Manuel A. Kanter. May 19, 1955. 43p.

Contract W-31-109-eng-38.

Diffusion in purified natural graphite crystals was studied by two techniques. Crystals with C^{14} atoms on the surface were prepared by heating at 1575°C for thirty minutes in a mixture of radioactive carbon monoxide and helium. These crystals were heated at diffusion temperatures *in vacuo*, and the C^{14} distribution within the crystals was determined by burning them slowly and measuring the radioactivity in the carbon dioxide produced. Diffusion measurements were carried out for times up to 25 hours in the temperature range 1840 to 2195°C . The results indicated that simultaneous diffusion into single crystal regions and into disordered regions occurred. Diffusion was also studied by measuring the rate at which C^{14} atoms were taken up by graphite crystals heated in radioactive carbon monoxide whose C^{14} concentration was maintained constant. The results were analyzed as diffusion from a surface maintained at a constant concentration. Diffusion experiments were carried out for times up to 80 hours at temperatures in the range 1995 to 2347°C . The results indicated that diffusion into single crystal regions was predominant at temperatures above 2150°C . The volume diffusion coefficient for graphite is $D = 40 f^2 \exp[(-163,000 \pm 12,000)/RT]$, where f is a geometry factor used because of the irregular shape of the crystals and is estimated to be $1/3$. The volume diffusion coefficient reported is for the direction parallel to the layer planes. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

6205 AD-18278

Ohio State Univ., Columbus. Cyogenic Lab.

THE THERMODYNAMIC PROPERTIES OF LIQUID NORMAL DEUTERIUM BETWEEN 20°K AND THE CRITICAL TEMPERATURE AND UP TO 100 ATMOSPHERES PRESSURE. Technical Report No. 24 on [LIQUID HYDROGEN AS AN AIRCRAFT FUEL]. David White, Maryanne Roode, and Herrick L. Johnston—Esther R. Fultz, ed. 21p. Contract W-33-038-ac-14794-(16243). (TR-264-24)

The thermodynamic properties of liquid normal deuterium have been calculated from the experimental data of state of the liquid, which covered the temperature range 20°K to the critical temperature. In these calculations the experimental data were extrapolated to 100 atmospheres pressure wherever necessary and interpolated at integral values of temperature and pressure. The calculated thermodynamic properties are summarized in six tables. (auth)

6206 TT-525

THE USE OF DEUTERIUM TO STUDY THE MECHANISMS OF THE REACTIONS OF ORGANIC COMPOUNDS.

(Primenenie Deiteriia k Issledovaniia Mekhanizmov Reaktsii Organicheskikh Soedinenii). G. P. Miklukhin. Translated by G. Belkov from *Uspekhi Khim.* **18**, 237-60(1949). 50p.

Fundamental studies using deuterium as an indicator in the study of the mechanism of organic reactions are re-

viewed. Mechanisms discussed include tautomeric conversion, cryptotautomerism, Kolbe electrochemical synthesis, disproportionation of aldehydes, the conversion of glucose in an alkaline solution; the polymerization of unsaturated hydrocarbons, the reaction of formaldehyde with hydrogen peroxide in heavy water, the formation of chloroform, transamination, exchange reactions in atomic groups, hydrogen migration in phenols, the Claisen rearrangement, thermal decomposition of acetaldehyde, catalytic hydration-dehydration, the use of deuterium to explain the structures of organic compounds, and the hydrogen and deuterium bond. 228 references. (C.H.)

6207

AN ACID CATALYSIS OF ISOTOPIC EXCHANGE OF HYDROGEN IN A MEDIUM OF LIQUID DEUTERIUM BROMIDE.

A. I. Shatenshtein, K. I. Zhdanova, L. N. Vinogradov, and V. R. Kalinachenko (Karpov Physicochemical Research Inst.). *Doklady Akad. Nauk S.S.S.R.* **102**, 779-82(1955) June 1. (In Russian)

6208

INVESTIGATION OF ORIGIN AND PATH OF HYDROGEN IN OXIDATION-REDUCTION REACTIONS. VIII. (Isotopic Effect in Canizzaro Reaction. G. P. Miklukhin and A. F. Rekasheva). *Zhur. Obshechei Khim.* **25**, 1146-52(1955) June. (In Russian)

FLUORINE AND FLUORINE COMPOUNDS

6209 NP-5718

Maine. Univ., Orono.

INVESTIGATION OF PHYSICAL AND PHYSICO-CHEMICAL PROPERTIES OF MIXTURES OF HYDROCARBONS AND FLUOROCARBONS. Final Report [for] January 2, 1952 to September 30, 1954. Robert D. Dunlap. June 17, 1955. 61p. Project No. TB-2-0001 (283). Contract DA-19-020-ORD-1323.

The effects of the chemical structure of certain hydrocarbons on such properties of the fluorocarbon-hydrocarbon systems as solubility, volume change on mixing, heats and energies of mixing, and related thermodynamic properties were investigated. Systems studied included pentane, hexane, and heptane and their corresponding perfluoro compounds. The mutual solubility of silicon tetramethyl and *n*-perfluoropentane was investigated. Several physical properties of *n*-perfluorohexane are reported. (See also NP-4779). (C.W.H.)

6210 NP-5721

Minnesota Mining and Mfg. Co., St. Paul.

[SYNTHESIS AND EVALUATION OF NEW POLYMERS]. Quarterly Progress Report No. 23 [for] November 15, 1954 through February 15, 1955. F. A. Bovey. 26p. Contract AF33(038)-515.

The preparation and properties of fluorine-containing rubbers are described. The object of the work is the development of elastomeric materials which are resistant to the fuels, lubricants, and hydraulic fluids used in military aircraft and which are serviceable over the widest possible temperature range. Copolymers of 1,1,2-trifluorobutadiene with FBA (1,1-dihydropyridyl acrylate) have been found to have good tensile strength, solvent resistance, and low temperature behavior, but are not resistant to ozone and oxygen. Traces of copolymerized acrylic acid have been found to be important for optimum cured properties in poly-FBA. Polymers containing about

0.15% give polyamine vulcanizates which have initial and over-aged strength superior to that of polymers containing lesser or greater amounts. A further study of plasticizers for poly-FBA has disclosed one non-fluorinated material (butyl carbitol formal) which is effective, but only polymeric materials resist extraction by solvents. Marked plasticization can be accomplished with silicone polymers, but swelling is excessive. Blends of Teflon and poly-FBA appear promising in strength and solvent resistance. (auth) (For preceding period see NP-5551.)

6211 NYO-7212

Cornell Univ., Ithaca, N. Y.

STRUCTURES OF FLUOROCARBONS, ELEMENTARY BORON, AND BORON COMPOUNDS. THE STRUCTURE OF SILVER PERFLUOROBUTYRATE. A. E. Blakeslee and J. L. Hoard. July 29, 1955. 17p. Contract AT(30-1)-878.

Crystals of silver perfluorobutyrate are monoclinic with $a = 6.46 \pm 0.01$, $b = 9.01 \pm 0.02$, $c = 13.11 \pm 0.04$ Å, $\beta = 100.2 \pm 0.03^\circ$, space group C_2 , and two dimeric molecules within the unit cell. Silver atoms lying on the twofold axes at O, ± 0.161 , O, etc., fix the signs of all of all hok reflections and of the real components of Okl reflections. Dimeric molecules, involving formation of an eight-membered central ring of two silver atoms and four carboxyl oxygens, exist in the crystal (and in benzene solution). (auth)

6212

THE SPECIFIC HEATS OF LITHIUM FLUORIDE, SODIUM CHLORIDE AND ZINC SULPHIDE AT LOW TEMPERATURES. Douglas L. Martin (Univ. of London). *Phil. Mag.* (7) 46, 751-8(1955) July.

The specific heats of lithium fluoride, sodium chloride and zinc sulfide have been measured within the temperature range 2°K to 30°K using a calorimeter of a novel type, upon which the crystal specimens were stuck with silicone grease. Ideally, these three substances have only a lattice contribution to their specific heats so that a direct comparison of the results with the theoretical predictions of the lattice theory of specific heats is possible. Good agreement between theory and experiment is found. The existence of a 'T³' region extending up to a temperature of about 20°K is shown clearly in the case of lithium fluoride. (auth)

6213

THE ELECTRIC MOMENTS OF SOME FLUOROCARBON DERIVATIVES. Max T. Rogers and Richard D. Pruett (Michigan State Coll., East Lansing). *J. Am. Chem. Soc.* 77, 3686-8(1955) July 20.

The electric moments of perfluoroethyl ether, perfluoro-tetramethylene oxide, chlorotrifluoroethylene and 1,1,2,2,3,3,3-heptafluoropropane have been determined from measurements of the dielectric constants of the gases at several temperatures. The electric moments of perfluorotriethylamine and ethyl perfluorobutyrate were measured in benzene solution at 25°C. The observed moments of the ethers are close to the values calculated by use of bond moments but the amine and ester have larger moments than calculated. The values have been discussed and compared with moments calculated on the basis of reasonable models for the molecules. (auth)

GRAPHITE

6214

REACTION OF ARTIFICIAL GRAPHITE WITH CARBON

DIOXIDE. REACTION OF ARTIFICIAL GRAPHITE RODS WITH CARBON DIOXIDE FROM 900° TO 1300°C. E. E. Petersen and C. C. Wright (Pennsylvania State Univ., University Park). *Ind. Eng. Chem.* 47, 1624-9(1955) Aug.

The influence of the characteristic properties of the solid state on integral reaction rates of graphite rods and CO₂ in the temperature range 900 to 1300°C has been investigated. Diffusion and chemical reactions occur simultaneously in the porous graphite rods. Results indicate that the over-all reaction rates are controlled by the chemical reaction step at the lower temperatures but that the diffusion step is important at the higher temperatures. (C.W.H.)

6215

REACTION OF ARTIFICIAL GRAPHITE WITH CARBON DIOXIDE. SURFACE AREA DEVELOPMENT WITHIN ARTIFICIAL GRAPHITE RODS REACTED WITH CARBON DIOXIDE FROM 900° TO 1300°C. E. E. Petersen, P. J. Walker, Jr., and C. C. Wright (Pennsylvania State Univ., University Park). *Ind. Eng. Chem.* 47, 1629-30(1955) Aug.

The effect of total surface area on integral reaction rates of partially reacted graphite rods and CO₂ in the temperature range 900 to 1300°C was investigated. Experimental results suggest that diffusion within the graphite pore system is rate controlling at these reaction temperatures. (C.W.H.)

6216

REACTION OF ARTIFICIAL GRAPHITE WITH CARBON DIOXIDE. UNIFORM GASIFICATION OF ARTIFICIAL GRAPHITE WITH CARBON DIOXIDE AT 1100°C. E. E. Petersen (Pennsylvania State Univ., University Park). *Ind. Eng. Chem.* 47, 1630-4(1955) Aug.

The rate at which graphite reacts with CO₂ at constant reactant concentration was found to be nearly proportional to superficial surface area of the particle system. Deviations are believed to be a result of a pore system developed with particles as a function of time. (auth)

6217

A CALCULATION OF THE DENSITY OF ELECTRON-TRAPPING DEFECTS IN NEUTRON-IRRADIATED GRAPHITE FROM MEASUREMENTS OF THE TEMPERATURE VARIATION OF THE HALL COEFFICIENT. D. F. Johnston (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* 1, 311-18(1955) June.

A model for the Hall effect in graphite is described. Theoretical curves are given for 200 and 300°K relating the Hall coefficient for a single crystal to the number of electrons trapped. The density of electrons (n/cm^3) trapped in irradiated graphite is deduced from the observed Hall coefficient, and found to be about 2.8×10^{19} per cm^3 at 200°K, and about 3.4×10^{19} per cm^3 at 300°K after a dose of 5×10^{19} thermal neutrons per cm^2 . The chemical potential ϵ_0 for a single crystal is calculated in terms of the temperature, and the density of trapped electrons. The effect of spin and orbital degeneracy w on the occupation of the trapping sites is considered. The density of electron-trapping defects N is first discussed, assuming a single trapping energy level ϵ_t in terms of a relation of the form

$$N = n \left\{ 1 + (2w)^{-1} \exp \left(\frac{\epsilon_t - \epsilon_f}{kT} \right) \right\}$$

where ϵ_t is found empirically from the temperature variation of n . The effect of more than one kind of trapping site is then considered. The various sources of error in an estimate of N are reviewed. Finally the probable value of N

after a dose of 5×10^{19} thermal neutrons/cm² is estimated to be about 1×10^{20} electron-trapping defects per cm³. (auth)

MOLECULAR STRUCTURE

6218 NP-5725

Pennsylvania State Univ., University Park. Coll. of Chemistry and Physics.

COORDINATION POLYMERS. Bimonthly Progress Report No. 3 [Covering] Period April 1, 1955 to May 31, 1955 [on] SYNTHESIS AND EVALUATION OF NEW POLYMERS. W. C. Fernelius, E. H. Holst, N. R. Garofano, and D. E. Goldberg. 13p. Contract AF 33(616)-2742.

The effect of reaction time on molecular weights of metal derivatives of bis(β -diketones) was investigated. The influences of other reacting conditions were also studied. Attempts were made to coordinate Co^{3+} with anions containing O and P. (C.W.H.)

6219 UCRL-3032

California. Univ., Berkeley. Radiation Lab.

INFLUENCE OF FLUORINE SUBSTITUTION ON THE PROPERTIES OF METAL CHELATE COMPOUNDS. I. COPPER (II) CHELATES OF BIDENTATE LIGANDS. R. Linn Belford, A. E. Martell, and M. Calvin. June 9, 1955. 37p. Contract W-7405-eng-48.

The ultraviolet, visible, and infrared absorption spectra of six β -diketones and their copper (II) chelates are presented and discussed in relation to the structure of these molecules. Infrared assignments are made. The 300 m μ bands of the metal chelates are shown to be shifted enolate ion absorptions. The order of magnitude and direction of those shifts are predicted correctly by a simple molecular orbital-electrostatic calculation. Visible chelate spectra are correlated with the nature of the chelating agent. The correlation agrees with crystal field theory predictions. (auth)

6220

MASS SPECTRA OF CYCLOPENTADIENYL METAL COMPOUNDS. PART I. BIS-CYCLOPENTADIENYL COMPOUNDS OF V, Cr, Fe, Co, Ni, Re, AND Ru, AND MANGANESE AND MAGNESIUM CYCLOPENTADIENIDES.

L. Friedman, A. P. Irsa, and G. Wilkinson (Brookhaven National Lab., Upton, N. Y. and Harvard Univ., Boston). *J. Am. Chem. Soc.* **77**, 3689-92(1955) July 20.

Mass spectra are given for the neutral bis-cyclopentadienyl compounds of V, Cr, Fe, Ni, Co, Ru, and $(\text{C}_5\text{H}_5)_2\text{ReH}$ and manganese and magnesium cyclopentadienides. The stability of parent molecule ions is greater in the bis-cyclopentadienyl-metal series. Differences in the spectra of the latter and the manganese and magnesium compounds are correlated with the nature of the metal to ring bond in the respective compounds. Appearance potentials are given for the prominent ions in most of the compounds and additional support for the correlations made from the spectra is obtained from these data. Confirmation of reported isotope abundances of V and Re also was obtained. (auth)

RADIATION CHEMISTRY

6221

RADIATION CHEMISTRY OF SOLUTIONS. M. Ebert and

P. Howard-Flanders. *Nature* **176**, 197-8(1955) July 30.

Sentence abstracts are presented of some of the papers given at the 5th annual meeting of the Société de Chimie Physique. The subject of the meeting was "Chemical Effects of Ionizing Radiation." (auth)

6222

γ -RAY-INDUCED DEUTERIUM GAS-WATER EXCHANGE. Sheffield Gordon and Edwin J. Hart (Argonne National Lab., Lemont, Ill.). *J. Am. Chem. Soc.* **77**, 3981-4(1955) Aug. 5.

Deuterium gas dissolved in light water has been found to undergo exchange with the protium of the water when these solutions are exposed to the γ radiation of Co^{60} . In neutral and acid solutions the major product of the exchange is hydrogen deuteride. Hydrogen is also formed in smaller yields. In alkaline solutions the hydrogen deuteride formation is suppressed whereas the hydrogen formation is unchanged over a wide range of pH's. The effects of pH, deuterium concentration, and dose rate have been determined, and a mechanism is postulated. (auth)

6223

HETEROGENEOUS CATALYSIS IN RADIATION CHEMISTRY. Moise Haissinsky and Anne-Marie Pujol. *Compt. rend.* **240**, 2530-2(1955) June 27. (In French)

The effect of γ radiation on Ag_2SO_4 solution has been studied. It was observed that the addition of metallic silver, metallic gold, and inert substances such as magnesium silicate and barium sulfate to the solution increased the amount of resultant ionization. It was also concluded that the observed catalysis is in strict relation to the presence of a solid phase. (B.J.H.)

RADIATION EFFECTS

6224

X-RAY DIFFRACTION AND CHEMICAL EXAMINATION OF SOME IRRADIATED NUCLEIC ACIDS. K. Little (Atomic Energy Research Establishment, Harwell, Berks, England) and P. W. Kent (Univ. Museum, Oxford, England). *J. Nuclear Energy* **1**, 280-5(1955) June.

Samples of deoxyribonucleic acid in the solid state have been irradiated by x rays, neutrons and γ -rays, and electrons. The main effect found has been disruption of phosphoric ester linkages. Otherwise the samples were highly radiation-resistant. With very high doses some nitrogen was removed, and an alternative crystal structure was observed. Specimens of *B. lactis aerogenes*, irradiated with x rays, were found to survive doses greater than those required to reduce the viscosity of aqueous nucleic-acid solutions. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

6225

TEST ON A THEORY OF SALINE SOLUBILITY IN THE AQUEOUS PHASE. SOLUBILITY OF THE SALTS OF THE RARE EARTHS. Geneviève Darmon and Georges Petit. *Compt. rend.* **241**, 299-301(1955) July 18. (In French)

Some general remarks are made on the theory of saline solubility, especially concerning the solubility of rare earths. (B.J.H.)

SEPARATION PROCEDURES

6226 AECU-3051

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

EQUIPMENT AND PRELIMINARY RESULTS FOR THE LEACHING OF UO_2 IN A BASIC CARBONATE CIRCUIT. TECHNICAL REPORT NO. VIII. Ray L. Pearson, Theron L. Mackay, Milton E. Wadsworth, and W. Martin Fassell, Jr. May 15, 1955. 15p. Contract AT(49-1)-633.

Equipment has been designed and constructed for the purpose of leaching pure uranium minerals in both acidic and basic circuits. This equipment provides a means for removal of a series of samples during any one run, control over speed of agitation, indication of gas over-pressure, and automatic temperature control. These units may be operated up to 1500 psi. Solid UO_2 samples were prepared by sintering under hydrogen to 1800°C. Preliminary results of the leaching of sintered UO_2 in a basic Na_2CO_3 - $NaHCO_3$ circuit resulted in the formation of an insoluble yellow precipitate (probably Na_2UO_4) for low concentrations of Na_2CO_3 - $NaHCO_3$. At higher carbonate concentrations no insoluble precipitate was formed and the rate of leaching was found to increase very rapidly above 300 psi. oxygen over pressure. (auth)

6227 BNL-174

Brookhaven National Lab., Upton, N. Y.

A CONTINUOUS FLOW PILOT PLANT FOR THE SEPARATION OF BROMINE-FLUORINE COMPOUNDS AND LIGHT END FISSION PRODUCT FLUORIDES FROM URANIUM HEXAFLUORIDE. W. R. Page, C. J. Raseman, E. I. Goodman, and C. H. Scarlett. Mar. 1952. Dec. Apr. 27, 1955. 38p.

A continuous process pilot plant with a capacity of 3 gram/hour feed for the separation of light end fission product fluorides and bromine fluorides from uranium hexafluoride has been constructed and operated with synthetic feeds containing tracer level light end fission product fluorides activity. A decontamination factor of 1700 has been obtained for tellurium. The iodine as iodine pentafluoride has been found to remain with the bromine trifluoride in the column separating this material from the product uranium hexafluoride. The tellurium activity has been found to split between what is evidently a completely non-volatile compound and the volatile tellurium hexafluoride. The product uranium hexafluoride contained less than 1 part in 1000 bromine. The over-all gamma decontamination factor for the tracer level material was about 1×10^6 ; the beta about 0.2×10^6 . For the uranium hexafluoride and the bromine trifluoride, the value of distillation column height equivalent to a one plate separation was found to be about twice that obtained when using n-heptane and methylcyclohexane. An outline plan for the expansion of the development work on the continuous process for high-level decontamination is included. (auth)

6228 NYO-6519

Columbia Univ., New York.

THE ION EXCHANGE CHARACTERISTICS OF PHOSPHORYLATED FABRICS. PROGRESS REPORT. R. E. Kameros and W. A. Selke. Apr. 1, 1955. 42p. Contract AT(30-1)1108.

Several types of cloths and phosphorylation procedures were investigated in an attempt to find a suitable phosphorylated fabric for use in a continuous countercurrent

ion exchange: Most of the materials investigated exhibit total exchange capacities in the range of commercial resins. Rate studies showed that liquid film diffusion is the rate-controlling mechanism. Results indicate that the cloth exchanger should be heavy, fine-fibred, and loosely woven. (C.W.H.)

6229 TIB/T4203

ALUMINIUM OXIDE WITH GRADED ADSORPTIVE CAPACITY FOR CHROMATOGRAPHIC ADSORPTION. (Aluminiumoxyd Mit Abgestuftem Adsorptionsvermögen Zur Chromatographischen Adsorption). Hans Brockmann and Hella Schodder. Translated from Ber. deut. chem. Ges. 74B, 73-8(1941). 7p.

The use of aluminum oxide as a separation filter for a mixture of colored components is discussed. Experiments were done to test and determine the adsorptive capacity of aluminum oxide. These experiments are described in detail. (B.J.H.)

6230

CONTINUOUS ION EXCHANGE. R. McNeill, E. A. Swinton, and D. E. Weiss (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia). J. Metals 7, 912-21(1955) Aug.

A simple method is described for illustrating diagrammatically the behavior of a countercurrent system, the equations being simplified by means of a concept the maximum hypothetical exchange performance. An example based on a typical metallurgical system is given, in which a divalent metal is recovered from a dilute solution, the resin being regenerated continuously by a monovalent ion. Useful conclusions are drawn from a study of the theory. Practical methods for performing continuous ion exchange are discussed, and the development of equipment based on modified ore dressing jigs is described. A swinging sieve jig contractor is evaluated experimentally. (auth)

6231

AN INVESTIGATION OF AN EXTRACTION COLUMN. A. Guyer, A. Guyer, Jr., and K. Meuli. Helv. Chim. Acta 38, 955-9(1955) June. (In German)

The efficiency and maximum diffusion of three types of extraction columns are investigated with the aid of a methyl-isobutyl ketone-water-acetic acid system from which the mixing intensity or number of stages per column length is observed. (tr-auth)

6232

SOLIDS CONCENTRATION. Nathaniel Arbiter (Columbia Univ., New York). Chem. Eng. 62, 164-77(1955) Aug.

The key properties of solids and basic separations concepts are reviewed. Processes for separation and concentration of solids discussed include sorting, gravity processes, magnetic separation, electrostatic separation, and flotation. (C.H.)

6233

DESIGN AND OPERATION FOR DIRECT-MAINTENANCE FUEL SEPARATION. H. K. Jackson and G. S. Sadowski (Oak Ridge National Lab., Tenn.). Nucleonics 13, No. 8, 22-5(1955) Aug.

A general discussion is given on the Oak Ridge Metal Recovery Plant, including flowsheets of the fuel separation process, general features of the building, processing equipment used, and capital cost. Performance shows that low-cost radiochemical plants can be operated with high efficiencies, and can be directly maintained with low radiation exposure to personnel. (B.J.H.)

6234

ANION-EXCHANGE STUDIES. XVII. MOLYBDENUM(VI), TUNGSTEN(VI), AND URANIUM(VI) IN HCl AND HCl-HF SOLUTIONS. Kurt A. Kraus, Frederick Nelson, and George E. Moore (Oak Ridge National Lab., Tenn.). *J. Am. Chem. Soc.* **77**, 3972-7(1955) Aug. 5.

The anion exchange behavior of Mo(VI), W(VI) and U(VI) was investigated with a strong base quaternary amine anion exchange resin in HCl solutions and in HCl-HF mixtures. The elements adsorb strongly at high HCl concentrations. Adsorption decreases with decreasing M HCl and, except for W(VI) which tends to precipitate, becomes negligible near $0.5M$ HCl. The adsorbabilities in HCl solutions containing $1M$ HF differ widely and separation is readily achieved. A number of separations of these elements from each other and from other elements, particularly Fe(III), are illustrated. The effect of cross-linking on the separations is discussed. (auth)

SYNTHESES

6235 NOL-CORONA-282

Naval Ordnance Lab., Corona, Calif.

HIGH TEMPERATURE DIELECTRIC MATERIALS.

Interim Report No. 7 [for] October 1954-May 1955. July 1955. 36p.

This project is sponsored by the Bureau of Ships, Dept. of the Navy under Project Order Nos. 10772/54 and 10775/55 and the WADC under MIPR 33(616)-55-62.

An attempt to obtain high-molecular-weight polymers from diphenylvinylsilane by the emulsion polymerization method failed. Modifications of the bulk polymerization method by stepwise addition of catalyst caused no increase in molecular weight of the diphenylvinylsilane polymers. Molecular weight determinations by analysis of the infrared spectrum of polydiphenylvinylsilane have been made. At the present there is no agreement among the three techniques of infrared absorption, chemical determination of Si-H hydrolysis, and the isopiestic method. The dielectric properties of a typical polymer sample have been measured and found to meet the anticipated requirements. Bisperfluoromethylchlorophosphine has been prepared from bisperfluoromethyliodophosphine quantitatively by the action of silver chloride. Bisperfluoromethyltrichlorophosphorus has been prepared in good yield from bisperfluoromethylchlorophosphine by the action of chlorine, and from the iodophosphine by the same reagent with poorer results. Bisperfluoromethyltrichlorophosphorus has been reacted with ammonia and ammonium chloride under a variety of conditions in an attempt to prepare the bisperfluoromethylphosphinic nitrides. As yet no pure compounds have been isolated from these reactions. Strong evidence has been gathered to show that at elevated temperatures the bisperfluoromethyltrichlorophosphorus undergoes an irreversible dissociation which results in the cleavage of perfluoromethyl groups from phosphorus. The preliminary unsuccessful attempts to prepare CF_3 -aluminum compounds by a wide variety of methods are discussed. (auth)

URANIUM AND URANIUM COMPOUNDS

6236 ANL-FGF-1

Argonne National Lab., Lemont, Ill.

PREPARATION OF ALPHA URANIUM SINGLE CRYSTALS.

E. S. Fisher. Dec. 1, 1954. Decl. Jan. 4, 1955. 22p. Contract [W-31-109-Eng-38].

In attempting to apply the strain-anneal method to preparing single crystals of alpha uranium from high purity material it was found that grain coarsening can be made to occur in such material by controlling the quantity of finely dispersed inhibitor. This could be done by varying the gamma phase temperature from which the uranium was quenched prior to fabrication and annealing in the alpha phase. Further control of grain coarsening was accomplished by diffusing small quantities of silicon into gamma uranium so that the fine inhibitor in the alpha phase was distributed in a concentration gradient. When suitably processed, by combining the optimum concentration gradient, the optimum final quenching temperature and a step-reduction fabrication schedule, the rods contained a distribution of inhibitor which permitted single crystals to be prepared as a result of grain coarsening during final alpha phase annealing. (auth)

6237 ANL-FGF-3

Argonne National Lab., Lemont, Ill.

AN ELECTROLYTIC PROCESS FOR REFINING

COMMERCIAL URANIUM. Robert Noland and Christopher Marzano. Aug. 2, 1953. Decl. Jan. 4, 1955. 40p. Contract W-31-109-Eng-38.

Commercially available uranium metal containing significant amounts of iron, copper, chromium, manganese, nickel, and silicon may be electrolytically refined to near spectroscopic purity in a fused salt electrolyte containing 33 wt.% uranium trichloride, 30 wt.% lithium chloride, and 37 wt.% potassium chloride. The electrolyte, contained in a Vycor or clear fused quartz cell is maintained at 400° to $425^\circ C$ under a protective argon or helium atmosphere which protects the bath, the anodes, and the product from excessive oxidation. Uranium anodes are employed, and the product in crystal form is deposited on a molybdenum or tantalum cathode. The metal crystals are silvery bright and very ductile as deposited. They may be consolidated into small ingots by vacuum melting in uranium dioxide crucibles without significant pickup of impurities. (auth)

6238 KAPL-1350

Knolls Atomic Power Lab., Schenectady, N. Y.

THE URANYL CUPFERRATES. W. S. Horton. June 10, 1955. 20p. Contract W-31-109-Eng-52

It is shown that the complex formed between uranyl ion and cupferron (ammonium nitrosophenylhydroxylamine) crystallizes in the cubic system with $a_0 = 13.3$ Å and space group T_4-P2_13 . Because of the space group symmetry, the UO_2 group is linear and the three cupferron residues must be equivalent. Therefore, the compound may be called ammonium uranyl cupferrate, $NH_4 [UO_2(C_6H_5N_2O_2)_3]$. The symmetry of the space group also requires that the arrangement of the oxygen atoms with respect to the central uranium atom be a trigonal bipyramid if the coordination number is five, and either a cube or dodecahedron for coordination number eight. These numbers cannot be distinguished from the information presently available. The uranyl cupferrate group is sufficiently stable to form compounds also with sodium, potassium, rubidium, and cesium in the place of the ammonium ion. The hydrogen compound, however, decomposes slowly on standing. A lithium compound may be prepared, but it is apparently more complex in nature than

the others. Methods for preparing these compounds are given. The aqueous solubilities appear to be moderately small. (auth)

6239

HYDROLYTIC BEHAVIOR OF METAL IONS. IV. THE ACID CONSTANT OF URANIUM(IV) AS A FUNCTION OF TEMPERATURE. Kurt A. Kraus and Frederick Nelson (Oak Ridge National Lab., Tenn.). *J. Am. Chem. Soc.* **77**, 3721-2 (1955) July 20.

The initial hydrolysis of U^{4+} at room temperature can be described by the equation $U^{4+} + H_2O \rightleftharpoons UOH^{3+} + H^+$ with the equilibrium constant:

$$k_{\theta 1} = \frac{m_{UOH^{3+}} m_{H^+}}{a_{H_2O} m_{U^{4+}}} G_{\theta 1} = \frac{k_{\theta 1}^m}{a_{H_2O}} G_{\theta 1}$$

where m is the molarity, $k_{\theta 1}^m$ the concentration quotient, $G_{\theta 1}$ the appropriate activity coefficient, and a_{H_2O} the activity of water. At an ionic strength $\mu \sim 0.5$, the experimental values for $k_{\theta 1}^m$ increased rapidly with temperature from 0.0125 at 10°C to 0.100 at 43°C. Values of $k_{\theta 1}$ of 0.075 and 0.66 at 10 and 43°C were estimated. From these values of $k_{\theta 1}$, $\Delta H^\circ = 11.7$ kcal and $\Delta S^\circ = 36$ eu were calculated. An explanation is proposed for the large positive entropy change for the hydrolysis reaction. (C.W.H.)

ENGINEERING

6240 HW-33953

Hanford Atomic Products Operation, Richland, Wash. LIMITING FLOW CAPACITY IN SOLVENT EXTRACTION PULSE COLUMNS. PART I: THE EFFECT OF PULSE AND CARTRIDGE GEOMETRY VARIABLES. W. H. Swift. Nov. 30, 1954. [Decl. Apr. 4, 1955]. 45p. Contract W-31-109-Eng-52.

A preliminary correlation of the effect of cartridge geometry and pulse variables is given for emulsion-type flooding in a simple sieve plate pulse column. (auth)

6241 NBS-2390a

National Bureau of Standards. Office of Basic Instrumentation, Washington, D. C.

A BARIUM-TITANATE ACCELEROMETER WITH WIDE FREQUENCY AND ACCELERATION RANGES. (DATA OBTAINED SINCE APRIL 1953). Thomas A. Perls and Charles W. Kissinger. June 1955. 39p. Sponsored by ONR; OSR; and AEC under Contracts Naonr-21-48 and CS-670-54-7.

Recent data and certain modifications are described for the NBS-33-14 series of barium titanate accelerometers. Data are tabulated on characteristics of loading mass, sensitivity, estimated linear acceleration range, unmounted resonant frequency, and mounted resonant frequency. A brief review of recent investigations related to barium-titanate accelerometers is appended. (C.H.)

6242 NBS-4121

National Bureau of Standards. Office of Basic Instrumentation, Washington, D. C.

A LARGE BARIUM-TITANATE ACCELEROMETER FOR SHOCK-VELOCITY MEASUREMENTS. Thomas A. Perls and Charles W. Kissinger. June 1955. 17p. Sponsored by ONR; OSR; and AEC under Contracts Naonr-21-48 and CS-670-54-7.

Design characteristics are described and illustrated of a large barium-titanate accelerometer having sufficient charge sensitivity to permit integration with a passive network and still retain enough output voltage that an impulsive change of velocity of 5 ft/sec can be recorded with good amplitude on any high-impedance 10-mv recorder. Application of this accelerometer in shock-velocity measurements is discussed. (C.H.)

HEAT TRANSFER AND FLUID FLOW

6243 AECU-2994

Minnesota. Univ., Minneapolis. Inst. of Tech. TWO-PHASE PRESSURE DROPS. H. S. Ishii, R. H. Moen, and D. R. Mosher. Nov. 1954. 98p. Contract AT(11-1)-210.

A survey of the literature on two-phase flow has been made with the purpose of critically examining design methods for evaluating pressure drops in steam-water mixture flows. Several simplified physical models have been used in developing equations and correlations for predicting pressure drops and flow rates. A discussion of the factors involved is presented along with several new comparisons between estimated pressure drops and experimental data. (auth)

6244 DTMB-802

David W. Taylor Model Basin, Carderock, Md. AN EXPERIMENTAL INVESTIGATION OF THE DRAG AND SHAPE OF AIR BUBBLES RISING IN VARIOUS LIQUIDS. W. L. Haberman and R. K. Morton. Sept. 1953. 57p. Project No. NS-715-102.

In connection with other investigations at the David Taylor Model Basin, detailed information became necessary on the motion of air bubbles in variable pressure fields. Since no information on the subject was available, a fundamental study of the motion of bubbles was undertaken. As an initial step, experiments were conducted to determine the drag and shape of single air bubbles rising freely in various liquids. The results of the experiments show that a complete description of the motion of air bubbles is not possible by use of dimensionless parameters containing the usual physical properties of the liquid (viscosity, surface tension, density). Three types of bubble shapes were observed in each liquid, namely spherical, ellipsoidal, and spherical cap. For a specific liquid, the shape of the bubble was a function of its volume. For tiny spherical bubbles, the drag coefficients coincide with those of corresponding rigid spheres. With increase in bubble size, a decrease in the drag as compared to that of rigid spheres occurs in some liquids. Thus, the drag curves of the spherical bubbles rising in various liquids fall between two limiting curves, namely the drag curve of rigid and fluid spheres, respectively. It was not possible to determine a criterion for the transition of the bubbles from "rigid" to fluid spheres. The region of ellipsoidal bubbles extends over different ranges of Reynolds numbers for the various liquids. The drag coefficients of spherical cap bubbles are independent of bubble size and have a constant value of 2.6. For bubbles (equivalent radius 0.03 to 0.30 cm) rising in tap water or in water containing certain surface-active substances, experiments show an increase in drag as compared to bubbles in pure water. Results of tests to determine the effect of the container walls on the velocity of rise are presented. A description of the experimental

apparatus is given. A summary of the theoretical and experimental work of other investigators is also included. (auth)

6245 LA-1862

Los Alamos Scientific Lab., N. Mex.

TAYLOR INSTABILITY AND LAMINAR MIXING. Garrett Birkhoff. Dec. 1954. 76p. Contract W-7405-eng-36.

Taylor instability involves 5 successive stages of mixing: infinitesimal amplitude, finite amplitude, Taylor's "asymptotic" interpenetration by spikes and round-ended columns, breakup of these spikes, and turbulent mixing. The existing theory of Taylor instability is critically reviewed and extended. This theory covers the first 3 stages in the growth of periodic disturbances of the interface separating 2 nonviscous incompressible fluids. (Using Fourier analysis, the first stage can be treated without assuming periodicity.) The analysis is based on classical hydrodynamics, supplemented by modern numerical methods. It is indicated how the fourth stage can be treated similarly. The fifth stage must be treated by statistical methods. (auth)

6246 NP-5713

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

WETTING EFFECTS ON BOILING HEAT TRANSFER.

Final Report [for] March 1, 1954 through May 31, 1955 [on] Project No. A-153. W. B. Harrison, Zelvyn Levine, Frank A. Thomas, Jr., and LeRoy A. Woodward. 66p. DA Project No. 599-01-004. Contract DA-01-009-ORD-368.

In order to study effects of wetting on heat transfer in the nucleate boiling regime, stearic acid was boiled in contact with different crystal planes of single crystals of copper, one of which was wetted by the acid and the other was not. Tentative data reported are to be checked and extended in a supplement to the present report. The present indications are that, in the region of low heat flux, where heat transfer is primarily non-boiling natural convection, the non-wetted, crystal required higher values of temperature difference than the wetted crystal for the same flux. This is consistent with the notion that, for heat transfer without phase changes, non-wetting conditions represent increased thermal resistance. At high values of heat flux, though not in the vicinity of the critical temperature difference, the situation was reversed. The non-wetted surface required lower temperature difference than the wetted surface. This is consistent with the notion that it is easier to form bubbles with non-wetting conditions than it is with wetting conditions. (auth)

6247 NP-5727

Mine Safety Appliances Co., Callery, Penna.

HEAT TRANSFER AND PRESSURE DROP WITH NaK-56 FLOWING PERPENDICULAR TO VERTICAL TUBES.

Memo Report No. 87. M. J. McGoff and J. W. Mausteller. July 29, 1955. 17p. Contract NObs-65426.

A cross-flow heat exchanger has been tested with liquid metal (NaK-56) as the heat transfer fluid. The heat exchanger consisted of twenty-five $\frac{1}{2}$ in. OD tubes arranged on a $\frac{5}{8}$ in. equilateral triangular pitch; five rows longitudinal and five rows transverse to flow. Operation was up to 900°F at Reynolds numbers of 3,000 to 80,000. Heat transfer coefficients varied to the 0.8th power of the Reynolds number and were higher than have been reported for mercury or pressurized water. Friction factors agreed with those obtained for the more common fluids. (auth)

6248 WADC-TR-54-372

North Carolina State Coll., Raleigh.

AN EVALUATION OF A DYE DISPLACEMENT TECHNIQUE FOR VELOCITY DISTRIBUTION MEASUREMENTS IN LAMINAR FLOW. James K. Ferrell. PROJECT NO. 1363. Project title: WIND TUNNEL STUDIES. Task title: BOUNDARY LAYER RADIOACTIVE TRACER TECHNIQUES. July 1954. 81p. Contract AF33(616)-31.

An evaluation has been made of a new technique using dye displacement for measuring the velocity distribution of liquids flowing in laminar flow inside circular tubes. The experimental method consists of spectrophotometric measurement of the rate of displacement of a dye solution in a glass tube by a clear solution entering the tube from above. This displacement rate is related to the velocity at points within the tube. This technique has the advantage over existing methods for measuring velocity distribution in that all measuring elements are outside the tube wall and thus the fluid is not disturbed at the point of measurement. When used for velocity distribution measurements, the method is limited by the radial molecular diffusion of the dye. A mathematical analysis of the diffusion problem has been made and the experimental data found to agree with the analysis. The method has been applied with water and glycerine flowing in a $\frac{1}{2}$ inch i.d. glass tube. Measurements to within 0.002 inches of the tube wall are in excellent agreement with the theoretical parabolic distribution equation. Based on the analysis of the diffusion problem it is inferred that the theoretical parabolic velocity distribution is valid for distances from the tube wall much less than 0.002 inches. The suggestion is made that the technique may be applicable to the measurement of the diffusion coefficient for liquids. It appears that the technique may also be applicable to the measurement of molecular and eddy diffusion for a fluid flowing in a turbulent flow and for velocity measurements within the laminar sub-layer of a fluid in turbulent flow. (auth)

6249 NACA-TM-1078

EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF CAVITATION IN WATER. (Experimentelle und Theoretische Untersuchungen Über Hohlraumbildung (Kavitation) im Wasser). J. Ackeret, Eidgenössischen Technischen Hochschule in Zurich, 1930. Translated by J. Vanier. 61p.

The cavitation in nozzles on airfoils of various shape and on a sphere are experimentally investigated. The limits of cavitation and the extension of the zone of the bubbles in different stages of cavitation are photographically established. The pressure in the bubble area is constant and very low, jumping to high values at the end of the area. The analogy with the gas compression shock is adduced and discussed. The collapse of the bubbles under compression shock produces very high pressures internally, which, according to more recent conceptions, are contributory factors to corrosion. The pressure required for purely mechanical corrosion is also discussed. (auth)

6250 TT-519

FLOW FORMS AND HEAT TRANSFER IN AIR-FLUIDIZED BEDS OF LOOSE MATERIAL. (Strömungsformen Und Wärmeübertragung in Von Luft Aufgewirbelten Schüttgutschichten). E. Wicke and K. Hedden. Translated by D. A. Sinclair from *Chem.-Ing. Tech.* 24, 82-91(1952). 33p.

Flow properties and hydrodynamic conditions in air-

fluidized particle beds were investigated. A test arrangement is described and methods for making heat transfer measurements in such beds in comparison with fixed beds of these materials are then dealt with and an interpretation of the test results is advanced. (auth)

6251

HEAT TRANSFER EXPERIMENTS WITH SODIUM AND SODIUM POTASSIUM ALLOY. W. B. Hall and A. E. Jenkins. *J. Nuclear Energy* **1**, 244-63(1955) June.

The theoretical approach to the problem of heat transfer in liquid metals is briefly reviewed. The difference between this approach and that used in the case of fluids with a high Prandtl number is due to the fact that the thermal conductivity of a liquid metal may be so high as to swamp the "eddy conductivity" in a turbulent stream. A description is given of experiments in which the heat-transfer coefficients between two annuli, each carrying a flow of liquid metal, were measured. Whilst a direct comparison with results obtained with a circular tube is not possible, the results are in quite good agreement with the theoretical values given by Lyon (1951). In the course of the work it was found that there were significant variations in temperature around the annuli carrying the liquid metal in the heat exchanger. It is thought that these variations were due to slight eccentricity of the exchanger tubes. An approximate theoretical treatment indicates that such variations are likely to be greater (when expressed as a fraction of the overall temperature difference) in the case of liquid metals than in the case of fluids with a higher Prandtl number. In these experiments, where the heat flux was about 50 watts per sq cm, the temperature variations were quite small, but if full advantage is taken of the liquid metal to obtain high heat fluxes, they might be so large as to produce serious thermal stresses and distortion of the heat exchanger. (auth)

6252

FREE CONVECTION IN AN OPEN THERMOSYPHON, WITH SPECIAL REFERENCE TO TURBULENT FLOW. B. W. Martin (King's Coll., Univ. of Durham). *Proc. Roy. Soc. (London)* **A230**, 502-30(1955) July 12.

An experimental investigation of heat transfer by free convection of a fluid in a heated vertical tube, sealed at the lower end, is described. Heated fluid adjacent to the wall is discharged from the open end into a suitably cooled large reservoir, while a central core of cool fluid is continuously drawn into the tube by way of replacement. The system may function under static conditions or under the influence of very large centrifugal accelerations. The effects of variations in the tube length-radius ratio and Prandtl numbers on the open thermosyphon system are estimated. The experimental results are compared to predicted results from Lighthill's theory of turbulent flow. (C.W.H.)

6253

PHOTOGRAPHIC STUDY OF BOILING. J. W. Westwater and J. G. Santagelo (Univ. of Illinois, Urbana). *Ind. Eng. Chem.* **47**, 1065-10(1955) Aug.

The photographic equipment and techniques used to obtain motion pictures of nucleate, transition, and film boiling are described. (C.W.H.)

MATERIALS TESTING

6254 ANL-5403

Argonne National Lab., Lemont, Ill.

DESIGN EVALUATION OF IN-REACTOR TUBE FOR

ARGONNE WATER LOOP AT MTR (ANL-2). L. W. Fromm. Mar. 1955. 44p. Contract W-31-109-eng-38.

A rigorous stress analysis is performed on a pressurized, in-reactor tube test facility (Type 347 stainless steel tube with Type 316 tip) to ensure conformity of the design with ASA and ASME Codes. Detailed calculations, along with tabulated and graphical data, show that the maximum membrane stress (14,200 psi) and the combined membrane and thermal stresses (22,200 psi) are well below the yield point of the steel. Calculated thermal gradients are lower than those accepted in commercial practice. Experimentally determined stresses and temperature gradients verify or are more favorable than corresponding calculated values. Radiation damage data are presented to show that even at saturation levels, the properties of Type 300 series stainless steels do not approach the limits at which embrittlement failure might be anticipated. (auth)

RADIOGRAPHY

6255

SCINTILLATION CRYSTAL-TV DEVICE X-RAY OBJECTS IN MOTION. John S. Pruitt (National Bureau of Standards, Washington, D. C.). *Nucleonics* **13**, No. 8, 26-9(1955) Aug.

A complete description is given of an instrument which continuously displays pictures produced by 50-Mev x rays. A NaI scintillation-crystal image converter transforms the x-ray image to an optical image, and a TV camera reproduces the image. The crystal performance and image definition are discussed in some detail. Applications are suggested. (B.J.H.)

TRACER APPLICATIONS

6256 AEC-tr-2190

AN EXPERIMENT ON THE APPLICATION OF RADIOACTIVE ISOTOPES TO THE STUDY OF THE PURITY OF VAPOR USED IN SEMI-INDUSTRIAL ULTRA-HIGH PRESSURE BOILERS. T. Kh. Margulova. Translated from *Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk*, No. 8, 29-36 (1954). 16p.

The method studied gave accurate results and is the only one possible in the case of a low salt content in boiler water. It was found necessary to use as isotopes those of elements which are ordinarily present in the boiler water. The type of compounds in the form of which the radioactive preparations are introduced into the apparatus must be characteristic for boiler conditions. (auth)

6257

THE USE OF NUCLEAR PLATES FOR THE MEASUREMENT OF THE DIFFUSIVITY OF AN ALPHA RAY ELEMENT INTO A SOLID. J. H. J. Poole and J. N. T. White. *Sci. Proc. Roy. Dublin Soc.* **27**, 1-15(1955) July 20.

The theory of a nuclear plate method of measuring the diffusivity of an alpha ray active tracer into a solid is developed. Some results for the diffusivity of polonium at various temperatures into nickel and lead are given, and the statistical errors inherent in the method discussed. It is suggested that the observed increase in the diffusivity with the depth of the layer of the metal considered may be due to the occurrence of grain boundary diffusion as well as lattice diffusion. The method is capable of measuring very small diffusivities, thus it is found that the diffusivity of polonium into nickel at air temperatures is of the order of 10^{-13} cm² per day. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

6258

PRODUCTION OF ZIRCONIUM DIBORIDE FROM ZIRCONIA AND BORON CARBIDE. Charles T. Baroch and T. E. Evans (U. S. Bureau of Mines, Boulder City, Nev.). *J. Metals* **7**, 908-11(1955) Aug.

ZrB₂ was produced in batches of 4 to 6 lb by interaction of ZrO₂, B₄C, B₂O₃, and carbon at around 2000°C in a simple graphite resistance furnace. Techniques of production are discussed and the final design of a suitable furnace is described in detail. Several other borides were made by the same technique and the process appears to have possibilities for commercial production. (auth)

6259

THE SOLID SOLUBILITY OF CHROMIUM CARBIDE, Cr₃C₂, IN TITANIUM CARBIDE. A. Carter (Imperial Chemical Industries, Ltd., Birmingham, England). *J. Inst. Metals* **83**, 481-4(1955) July.

X-ray-diffraction methods show that TiC dissolves up to 51 wt. % Cr₃C₂ at 1725°C, the temperature of maximum solubility. The solubility falls rapidly with decreases in temperature, being only about 4% at 1300°C. The remainder of the TiC-Cr₃C₂ pseudo-binary diagram has been explored in outline by metallographic and x-ray-diffraction techniques. The system is of a simple eutectic type, and the eutectic composition and temperature have been found to be about 4% TiC and 1725°C, respectively. No evidence of any solid solubility of TiC in Cr₃C₂ has been obtained. (auth)

CERAMICS AND REFRACTORIES

6260 AWRE-O-15/55

Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.

INVESTIGATION OF REFRACTORY METAL-OXYGEN SYSTEMS FOR POSSIBLE NEW CERAMIC COMPOSITIONS. W. J. Kramers, W. B. Rotsey, J. R. Smith, and D. R. Whittaker. May 6, 1955. 81p.

The phase distribution and properties obtained in various refractory metal-oxygen systems including titanium, zirconium, chromium, thorium and tantalum are described. Microscopic, x-ray and micro-hardness determinations have been used to characterize the phases obtained in both binary and multi-component systems. The resistance of some of the compositions prepared to oxidation and to molten titanium has also been briefly investigated. (auth)

CORROSION

6261 NP-5716

Case Inst. of Tech., Cleveland.

HIGH TEMPERATURE SCALING OF NICKEL-MANGANESE ALLOYS. Technical Progress Report No. 1 [for] August 1953 to March 1955 [on] THERMODYNAMICS AND KINETICS OF METALS AND ALLOYS. E. B. Evans W. M. Baldwin, Jr., and C. A. Phalnikar. June 1955. 57p. DA Project No. 5B99-01-004. Contract DA-33-019-ORD-1077.

Scaling rates and scale compositions of nickel-manganese alloys were determined. All the alloys scaled according to the parabolic rate law between 600 and 1000°C. At any given temperature the scaling rate increased at low manganese concentrations then leveled off at intermediate concentrations, approaching the scaling rate of manganese as the upper limit. Both an external scale and a subscale were found after scaling, the scale composition being a function of alloy composition and temperature. Above a critical concentration of manganese (15% at 600°C to 60% at 1000°C) the external scale consisted exclusively of manganese oxides and the subscale was MnO. Below this critical concentration complex external scales consisting of the oxides of both nickel and manganese were found along with subscales of either NiO or a solid solution of the monoxides (MnO + NiO). The spinel oxide (NiO·Mn₂O₃) found in most of the complex scales was not associated with improved oxidation resistance. Schematic isothermal sections of the deduced Ni-Mn-O phase diagram were applied as an aid in interpreting the scaling behavior. It is concluded that none of the current theories of scaling of alloys describes the present case. (auth)

6262 TAM-88

Illinois. Univ., Urbana.

FACTORS INFLUENCING FRETTING FATIGUE STRENGTH. Technical Report No. 46 on THE BEHAVIOR OF MATERIALS UNDER REPEATED STRESS. H. T. Corten. June 1955. 34p. Project NR-031-005. Contract N6-ori-071(04).

The influence of clamping pressure on the fretting fatigue strength of 24S-T aluminum alloy was investigated. The strength was reduced to approximately 50% of the unfretted fatigue strength due to clamping between aluminum clamping pads at a nominal pressure of 4000 psi. Higher clamping pressures produced only a small additional reduction of strength. The influence of dissimilar clamping pad materials, including aluminum, brass, soft and hard steel, on the fretting endurance limit of hard steel was investigated. The strength of the hard steel specimens, due to fretting against aluminum, soft steel, brass, and hard steel clamping pads, was reduced to 91%, 81%, 59%, and 50%, respectively, of the unfretted endurance limit. A microhardness study indicated that the hardness of the steel specimen surface was increased due to fretting against aluminum pads, unchanged due to fretting against either soft or hard steel pads and, decreased due to fretting against brass pads. These results are discussed in terms of the behavior of asperities (microscopic high points) subjected to normal and shear forces and the influence of thin oxide layers. (auth)

6263 WADC-TR-54-109

Kentucky. Univ., Lexington. Kentucky Research Foundation.

SCALING OF TITANIUM AND TITANIUM ALLOYS. [PERIOD COVERED] NOVEMBER 15, 1951 TO JANUARY 1, 1954. H. W. Maynor, Jr., B. R. Barrett, and R. E. Swift. Mar. 1955. 136p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF18 (600)-60.

A preliminary study of the scaling characteristics in air of experimentally produced titanium and titanium-base alloys, and commercially-produced titanium and titanium-base alloys was conducted at temperatures of 1200, 1400, 1600, and 1800°F (650, 750, 870, and 980°C) in the time

range of approximately four to three hundred hr. A total of forty-three titanium-base alloys, one commercial grade of titanium (RS-70), and Type 302 stainless steel were scaled at each of these temperatures; two additional alloys were employed at temperatures of 1200 and 1600°F. Scales formed on a 4.02% Al-Ti alloy were studied in detail and a scaling mechanism was suggested; scales formed on a 4.03% Cr-Ti alloy and a 2.95% W-Ti alloy were studied in less detail. Scaling propensity of titanium-base alloys, relative to titanium and stainless steel, was evaluated on the basis of weight gain with time. Attempts to evaluate scaling propensity on the basis of weight loss with time, through the application of various descaling processes, were unsuccessful; however, results of essentially the same nature were obtained in terms of inches penetration of oxide scale. Isothermal transitions in the parabolic scaling rate were observed for experimentally produced titanium at 1200°F; transitions were observed, but not studied in detail, for 3.96% Mo-Ti at 1400°F., 1.19% Mo-Ti at 1600°F., and 0.91% Ni-Ti at 1600°F.; transitions were indicated, but not studied in detail, for experimentally produced titanium at 1800°F. (auth)

6264 AERE-Lib/Trans-525

THE USE OF BOEHMITE LAYERS FOR PROTECTION AGAINST CORROSION OF PURE ALUMINIUM, REFINED ALUMINIUM AND SOME ALLOYS RESISTANT TO CORROSION. D. Altenpohl. Translated by F. Hudswell from *Aluminium* 31, 10-14; 62-9(1955). 27p.

The experimental results indicate that boehmite films serve as a protection against the corrosion of Al. The deposition of boehmite films on Al can easily be made with steam or with boiling distilled water, sometimes with a small addition of soda. Boehmite films which are satisfactory for corrosion protection are about 20 to 200 times as thick as the natural oxide skin. The stability of Al against weak acids and Cl ions is increased by suitable films of boehmite by a factor of between 8 and 30. (auth)

6265

DESIGN AND APPLICATION OF CORROSION CURRENT MEASURING INSTRUMENTS. Donald L. Ham (Sensitive Research Instrument Corp., Mount Vernon, N. Y.). *Corrosion* 11, 343t-6t(1955) Aug.

The three principal kinds of instruments used to measure currents associated with corrosion are described and their circuit diagrams illustrated. Considerations involved in selecting the correct instruments for several kinds of current measuring problems are reviewed and the capacities and limitation of the applicable instruments evaluated. Examples of typical uses are given. (auth)

6266

STRESS CORROSION CRACKING OF HARDENABLE STAINLESS STEELS. F. K. Bloom (Armco Research Labs., Baltimore). *Corrosion* 11, 351t-61t(1955) Aug.

Hardenable stainless steels, like other high-strength steels, are susceptible to cracking under the combined influence of tensile stress and corrosion, depending on the severity of the stress, the nature of the media and to a large extent, on their hardness. The most severe conditions are acid solutions containing sulfides, which promote entry of hydrogen into the steel and where chlorides are present to promote pitting. In such media cracking may occur in the standard grades under stress at hardnesses of Rockwell C24, in severe marine atmospheres at C40 and in industrial atmospheres at C45. Type 422, a modified 12 percent chro-

mium alloy, tempered at 1200 F to Rockwell C30 and the precipitation-hardening alloys, 17-4 PH and 17-7 PH, overaged to the same hardness level were the most resistant materials tested. Types 410, 416 and 431 performed as well as or somewhat better than low alloy steels when heat treated to equivalent hardness levels. Tempering them at 1100 F or higher temperatures provided good resistance to cracking in the severest media. Internal stresses generated during quenching can promote stress corrosion cracking without imposing additional external stresses. Interrupted quenching (martempering) is helpful in minimizing stresses from this source and is recommended as a heat treating practice for valve trim and other parts used fully hardened in service likely to cause corrosion cracking. (auth)

6267

TEFLON-IMPREGNATED BEARINGS FOR SERVICE IN WATER. H. B. Nudelman and Cord H. Sump (Armour Research Foundation, Chicago). *Metal Progr.* 68, No. 2, 112-13(1955) Aug.

It has been found that porous stainless steel bearings can be used, when water must be used as the lubricant, by impregnating the bearings with Teflon. (B.J.H.)

GEOLOGY AND MINERALOGY

6268 TEI-494

Geological Survey.

RADIOACTIVE COAL AND SHALE OF PENNSYLVANIAN AND PERMIAN AGE IN NORTHERN WEST VIRGINIA.

E. D. Patterson. Dec. 1954. 17p.

The commercially important coal beds in the Monongahela series of Pennsylvanian age and coal and shale of the Dunkard series of Permian age were examined and sampled in eight counties in northern West Virginia. Most coal examined was non-radioactive, but a few carbonaceous shales and coaly beds in the Dunkard series were weakly radioactive, yielding 0.002 to 0.004% equivalent uranium. The principal beds sampled are the Pittsburgh and Redstone coal beds of the Monongahela series. (auth)

6269

ON THE DISTRIBUTION OF THORIUM IN ALLANITES.

P. Pellas. *Bull. soc. franc. mineral. et crist.* 78, 257-61 (1955) Apr.-June. (In French)

The radioactivity of the allanites is due to the presence of thorium distributed at random in the leucomae of the reticulum, in substitution for the ceric earths, and to the presence of radioactive inclusions (frequent thorite, niobotantalates, etc. . .). It is the first type of distribution of radioactivity which produces the mineral transitions to the metamict state if the geological age of the mineral is great enough. (tr-auth)

6270

PRELIMINARY GEOLOGIC MAP OF THE URAVAN QUADRANGLE, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 24. Fred W. Cater, Jr. and E. J. McKay. Washington, U. S. Geological Survey, 1955. \$0.50.

6271

PRELIMINARY GEOLOGIC MAP OF THE JUANITA ARCH QUADRANGLE, COLORADO. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF 28. E. M. Shoemaker. Washington, U. S. Geological Survey, 1955. \$0.50.

6272

AGE AND SEDIMENTARY ENVIRONMENTS OF URANIUM HOST ROCKS, COLORADO PLATEAU. Y. W. Isachsen, T. W. Mitcham, and H. B. Wood. *Econ. Geol.* 50, 127-34 (1955) Mar.-Apr.

On the Colorado Plateau, uranium mineralization has been found in 32 sedimentary units that range in age from Pennsylvanian to Tertiary, and in a Tertiary monzonite porphyry. Ore has been produced from 22 of these units. Host rocks represent all major sedimentary environments except glacial. The wide variation in age and depositional environments of the host rocks suggests an epigenetic origin for uranium ore on the Colorado Plateau. (auth)

6273

ORE CONTROLS IN SANDSTONE URANIUM DEPOSITS OF THE COLORADO PLATEAU. Robert J. Wright. *Econ. Geol.* 50, 135-55(1955) Mar.-Apr.

Marked lithologic control characterizes most uranium deposits in sandstone formations of the Colorado Plateau. Deposits in rocks ranging in age from the Cutler formation of Permian age to the Wasatch formation of Eocene age are primarily in fluvial sandstones which contain carbonized plant matter, are light-colored or gray, rather than red, and contain feldspar or mica. In addition, sandstones that are interbedded with or interfingering with shales or mudstones are particularly favorable. These features are also characteristic of most sedimentary copper deposits. Most uranium deposits in sandstone formations show no immediate connection with tectonic features, but a general clustering of orebodies around large positive structures is noted. The reason for this is not clear. It is postulated that at least some of the uranium in the ores was derived from the same source as the host rocks. In this light the sandstone uranium deposits may be the continental analogue of uranium-rich marine black shales and phosphorites. Sedimentary copper deposits may have had a similar origin. Uranium moving seaward in streams, during erosion of a land mass, may be fixed on the continent in certain favorable fluvial environments. (auth)

6274

URANIUM ORE GUIDES, MONUMENT VALLEY DISTRICT, ARIZONA. Thomas W. Mitcham and Charles G. Evensen. *Econ. Geol.* 50, 170-76(1955) Mar.-Apr.

The contact between the Shinarump conglomerate and the Moenkopi formation, both of Triassic age, is a marked erosional unconformity. Basal Shinarump sediments fill ancient stream channels incised into the underlying Moenkopi. On the Colorado Plateau uranium ore deposits are commonly found in these stream channels. Paleostream channels are the prime guide to ore in the Shinarump. Twenty-seven others of varying degrees of usefulness are summarized. (auth)

6275

MINERALOGY OF A URANINITE-BEARING PEGMATITE, LAC LA RONGE, SASKATCHEWAN. Robert B. Ford. *Econ. Geol.* 50, 196-205(1955) Mar.-Apr.

The Nunn Lake uraninite pegmatite is a large, well zoned sill-like body. Uraninite occurs within the outer three feet of the wall zone, as sheet-like masses within an aplitic phase of the pegmatite, and as late fracture fillings. Deposition of the uraninite took place in two stages. The first stage was crystallization within and contemporaneous with the potassium-rich wall zone. The second stage was the crystallization of the uraninite within aplitic phases of the

pegmatite and as late fracture fillings. This second stage of uraninite crystallization is in direct association with a mineral assemblage that is evidence of a late residua of alkali potassium silicate assemblage that is evidence of a late residua of alkali potassium silicate and the acid radicals of the halides. (auth)

6276

ON THE CARBON-13 ABUNDANCE OF LIMESTONES AND COALS. P. M. Jeffery, W. Compston, D. Greenhalgh, and J. de Laeter (Univ. of Western Australia, Nedlands). *Geochim. et Cosmochim. Acta* 7, 255-86(1955) June.

The carbon isotopic compositions of about one hundred specimens of limestones and coals of Australian origin have been determined. Various depositional, diagenetic, and post-depositional processes which may have produced the carbon isotopic composition of the specimens are discussed. It has been shown that the observed variations in isotopic composition are not due entirely to varying depositional environments in the case of the limestones, and possibly not due entirely to differing original plant biotopes in the case of the coals. Such anomalous variations can be attributed only to changes in the isotopic composition of the hydrosphere and atmosphere from one time to another. It is suggested that the fundamental causes for these variations are the periodic diastrophisms which change the balance of the carbon cycle in the lithosphere. This would imply a definite "age-effect." (auth)

6277

GERMANIUM AND URANIUM IN COALIFIED WOOD FROM UPPER DEVONIAN BLACK SHALE. Irving A. Breger and James M. Schopf (U. S. Geological Survey, Washington, D. C.). *Geochim. et Cosmochim. Acta* 7, 287-93(1955) June.

Microscopic study of black, vitreous, carbonaceous material occurring in the Chattanooga shale in Tennessee and in the Cleveland member of the Ohio shale in Ohio has revealed coalified woody plant tissue. Some samples have shown sufficient detail to be identified with the genus *Calixylon*. Similar material has been reported in the literature as "bituminous" or "asphaltic" stringers. Spectrographic analyses of the ash from the coalified wood have shown unusually high percentages of germanium, uranium, vanadium, and nickel. The inverse relationship between uranium and germanium in the ash and the ash content of various samples shows an association of these elements with the organic constituents of the coal. On the basis of geochemical considerations, it seems most probable that the wood or coalified wood was germanium-bearing at the time logs or woody fragments were floated into the basins of deposition of the Chattanooga shale and the Cleveland member of the Ohio shale. Once within the marine environment, the material probably absorbed uranium with the formation of organo-uranium compounds such as exist in coals. It is suggested that a more systematic search for germaniferous coals in the vicinity of the Chattanooga shale and the Cleveland member of the Ohio shale might be rewarding. (auth)

6278

THE CONVERGENT LEAD AGES OF THE OLDEST MONAZITES AND URANINITES (RHODESIA, MANITOBA, MADAGASCAR, AND TRANSVAAL). L. H. Ahrens (Oxford Univ., England). *Geochim. et Cosmochim. Acta* 7, 294-300(1955) June.

The lead-age distribution ($\frac{208}{238}$, $\frac{207}{235}$, $\frac{206}{238}$, and $\frac{207}{206}$) of three specimens of Rhodesian monazite form a regular pattern. Such an array, produced evidently by varying lead loss, may

be used for a precision estimate of age—the convergent age. The convergent age of each Rhodesian monazite is estimated at $2,680 \times 10^6$ years. The lead-age distributions of monazite from Antsirabe, Madagascar, and uraninite from the Huron Claim, south-eastern Manitoba, fit an extension of Rhodesian age pattern closely ($\pm 20 \times 10^6$ years) and hence their convergent ages are estimated also at $2,680 \times 10^6$ years; uraninite from Klerksdorp, Transvaal, may have a similar age. The convergent ages of those most primitive specimens are somewhat greater (50 to 700×10^6 years) than previously recommended estimates. The formation of a well-ordered age array suggests that physical causes, rather than chemical, have controlled lead loss. (auth)

METALS AND METALLURGY

6279 AD-27982

Illinois Inst. of Tech., Chicago.

A STUDY OF CONTROLLED ATMOSPHERES FOR THE HEAT TREATMENT OF ALLOY STEELS. TECHNICAL REPORT NO. 4 [FOR] APRIL 1, 1953–JANUARY 31, 1954. Fred Kisslinger. Mar. 17, 1954. 15p. Contract DA-11-ORD-993.

Data are presented from determinations at 1000°C of equilibrium conditions between $\text{CO}-\text{CO}_2$ mixtures and alloy austenites. The activity of carbon in austenite is increased by the presence of Ni. (J.E.D.)

6280 AECU-3056

Commonwealth Engineering Co. of Ohio, Dayton, Ohio. GAS PLATED COATINGS ON METALS AND ALLOYS. PROGRESS REPORT NO. 5. July 6, 1953. 16p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 526.

Cr and Cr–Ni alloys were successfully coated on Ni-flashed copper base. The success of a two-temperature technique of gas plating from chromium carbonyl in minimizing carbon content in the resultant plates was confirmed and extended. The recovery and resublimation of chromium hexacarbonyl were studied, and conditions for optimum procedure suggested. (For preceding period see AECU-2667.) (auth)

6281 AECU-3057

Commonwealth Engineering Co. of Ohio, Dayton, Ohio. GAS PLATED COATINGS ON METALS AND ALLOYS. PROGRESS REPORT NO. 6 AND FINAL REPORT. June 5, 1953. 37p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 526.

The gas plating of copper base metal with Cr metal from chromium hexacarbonyl vapor and with Cr–Ni plating from a mixture of chromium hexacarbonyl and nickel tetracarbonyl was investigated. Physical, chemical, and metallurgical aspects of the problem were outlined. Techniques are given for evaluating plating efficiency and plating control. (For preceding period see AECU-3056.) (C.W.H.)

6282 ATI-16192

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

LITERATURE REVIEW AND INDUSTRIAL SURVEY OF BRAZING. Final Report [on] Project No. 90-1060-B. R. R. Banks, N. Bredzs, and John M. Parks. June 12, 1952. 190p. Contract DA-11-022-ORD-324.

Brazing methods are presented for the purpose of

introducing brazing operations. A discussion of the base metals commonly brazed, the brazing alloys, fluxes, and the basic metallurgy of the process are briefly reviewed. A section on the design of brazed joints is covered, in order to acquaint the reader with the mechanics of brazed joints and its engineering implication. (auth)

6283 BM-IC-7723

Bureau of Mines.

A SURVEY OF THE LITERATURE ON THE ELECTRODEPOSITION OF MOLYBDENUM. T. T. Campbell and A. Jones. July 1955. 8p.

A literature survey was made covering the use of aqueous, non-aqueous, and fused salt systems for the electrowinning or electroplating of molybdenum metal. (auth)

6284 BMI-T-39

Battelle Memorial Inst., Columbus, Ohio.

TENSILE PROPERTIES OF SHEET ZIRCONIUM AT ROOM AND ELEVATED TEMPERATURES. A. D. Schwoppe, S. J. Stockett, and G. T. Muehlenkamp. Oct. 1, 1950. Changed from OFFICIAL USE ONLY Feb. 21, 1955. 21p. Contract W-7405-eng-92.

Tensile tests at temperatures up to 600°F show that the tensile strength of zirconium sheet decreases from 38,000 psi. at room temperature to 17,000 psi. at 600°F ., a decrease of about 55%. The 0.2% offset yield strength changes from 24,000 psi. to 10,000 psi. over the same temperature range, a decrease of about 58%. The yield strength in the transverse direction is slightly higher than in the rolling direction throughout the temperature range, while the ultimate strength is higher for the longitudinal direction. The “n” value, the work hardening index, increases with temperature, from 0.14 to 0.23 for the longitudinal direction, and from 0.08 to 0.18 for the transverse direction. This indicates that more ductility is available at high temperatures than at room temperature; i.e., it would be advantageous to carry out severe forming operations at temperatures above 400°F . The dynamic modulus of elasticity at elevated temperatures is somewhat higher than the values obtained in the tensile tests. A probable explanation is that at the higher temperatures the proportional limit is very low and the extensometer used was not sufficiently sensitive to establish the correct modulus value. (auth)

6285 NP-5723

Pennsylvania. Univ., Philadelphia. School of Metallurgical Engineering.

GRAIN BOUNDARY DISPLACEMENT VERSUS GRAIN DEFORMATION AS THE RATE DETERMINING FACTOR IN CREEP. Technical Report No. 5. J. A. Martin, M. Herman, and N. Brown. July 28, 1955. 13p. Contract DA 36-034-ORD 291RD.

The height of the vertical grain boundary displacements were measured on creep specimens of beta brass. The displacements followed a normal distribution whose standard deviation was a function of strain and was independent of temperature from 450 to 501°C . The strength of the grain and not the shear resistance of the boundary was found to be the rate controlling factor in the creep of beta brass. (auth)

6286 NP-5724

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab. THE FREE ENERGY CHANGE OF AUSTENITE—

PEARLITE TRANSFORMATIONS. Annual Report [for] June 1, 1954 to June 1, 1955. Guy M. Pound and John J. Kramer. June 24, 1955. 17p. DA Project No. 599-0-004. Contract DA-36-061-OR-350.

Two methods of investigation of the interfacial energy between cementite and ferrite in pearlitic eutectoids were continued. Evaluation of the interfacial energy from a determination of the reaction temperature of the pearlite to austenite transformation as a function of pearlite spacing and heating rate was made. The change of the transformation temperature of the pearlite to austenite reaction as a function of pearlite spacing (as obtained from superheating data) and its relationship to interfacial are discussed. A calorimetric investigation of the surface energies of the iron-carbon eutectoids and the system copper-aluminum was made. Preliminary investigation of the non-ferrous pearlitic eutectoids indicates a much smaller interfacial energy than that determined in the iron-carbon system (less than 600 ergs/cm² in the copper-aluminum system as compared to 1000 ergs/cm² measured in the iron carbon system). (auth)

6287 TAM-87

Illinois. Univ., Urbana.

INFLUENCE OF STRAIN AGING ON THE SHAPE OF THE S-N DIAGRAM. Technical Report No. 45 on THE BEHAVIOR OF MATERIALS UNDER REPEATED STRESS. F. C. Rally and G. M. Sinclair. June 1955. 40p. Project NR-031-005. Contract N6ori-071(04).

An investigation was made to determine the influence of strain aging on the shape of the stress-number diagram. Fatigue tests were conducted on an S. A. E. 1018 steel at 70, 140, 250, and 440°F and for three different carbon and nitrogen contents to determine the effect of temperature and of carbon and nitrogen content on the position of the "knee" in the S-N diagram. Statistical methods were used to define the knee position in terms of the experimental data. It was found that the position of the knee in the S-N diagram was influenced by the carbon and nitrogen content of the steel and also by the temperature at which the tests were conducted. These changes occurred in a manner which was qualitatively consistent with predictions which may be made from strain aging theory. (auth)

6288 TID-4005(Pt.1, 3rd Ed.)

Technical Information Service, AEC.

SUMMARIES OF PHYSICAL RESEARCH PROJECTS IN METALLURGY. Mar. 1955. 68p.

Physical research in the production treatment, and properties of materials, alloy theory and the nature of solids, and radiation effects on materials are summarized. (B.J.H.)

6289 WADC-TR-53-272(Pt.2)

Bureau of Mines, Albany, Oreg.

CHROMIUM-BASE ALLOYS. [Period Covered] June 15, 1953 to September 15, 1954. Haruo Kato and Earl T. Hayes. Apr. 1955. 17p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract [AF]33(038)-50-1084-E.

The high-temperature stress-rupture properties of alloys of 60Cr-40Fe to which was added either molybdenum, nickel or cobalt were investigated. Improvements in alloy preparation involving the use of high-purity stock and consumable-arc melting lowered the oxygen content from approximately 3000 to 300 ppm and improved ductility.

These alloys showed very short creep rupture life at 1500°F and 20,000 psi. (auth)

6290 WADC-TR-53-455

Michigan. Univ., Ann Arbor.

APPLICATION OF THE POLAROGRAPH TO ANALYSIS OF TITANIUM-BASE ALLOYS. Philip J. Elving, Charles L. Ruifs, Joseph L. Lagowski, Julian Lakritz, and Robert J. Meyer. Mar. 1955. 40p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: COMPOSITIONAL ANALYSIS. Contract AF 18(600)-379.

The possible application of the polarographic techniques of direct concentration measurement and amperometric titration to the analysis of titanium-base alloys has been investigated. A procedure is described for the simultaneous determination of chromium and estimation of iron in titanium-base materials. The procedure involves a general technique for the dissolution of titanium-rich materials in hydrofluoric acid followed by separation of most of the titanium as insoluble potassium hexafluorotitanate. In the specific procedure described, excess fluoride is then largely removed by an evaporation in the presence of sulfuric acid and the chromium is oxidized to chromate by persulfate. Treatment with ammonia and cyanide serves simultaneously to complex the iron as the soluble ferricyanide and precipitate the residual titanium as hydroxide. The solution is then made strongly alkaline and polarographed. Chromium results are excellent, while those for iron are only fair. A rapid method for the polarographic determination of iron in titanium-base alloys has been developed, using a modified citrate procedure. Hydrofluoric acid is used to dissolve the sample. Aluminum ion is then introduced to complex the fluoride ion and potassium citrate is added as a supporting electrolyte. The polarogram is recorded and the current, after a blank correction has been applied, is compared to a previously determined standardization curve. It is possible to obtain accurate results for iron contents ranging between 0.2 and 5.0%. A complete determination can be completed in 15 to 20 minutes. A rapid and precise amperometric titration method for the determination of vanadium in titanium-base alloys has been developed. Sulfuric acid or hydrofluoric acid followed by sulfuric acid evaporation is used to dissolve the sample. Standard ferrous solution is the titrant and a rotating microplatinum electrode is used as the indicator electrode. Specifically, titanium, iron, manganese, chromium, copper, magnesium, aluminum, and moderate amounts of molybdenum and tungsten do not interfere. In addition, a large number of other elements do not interfere. Pertinent material from progress reports related to this contract has been extracted and is included in this report as appendixes. (auth)

6291 WADC-TR-54-485(Pt.1).

National Bureau of Standards, Washington, D. C.

ELECTRODEPOSITION OF TITANIUM. [Period covered January 1953 through June 1954]. Walter E. Reid, Jr., Joseph M. Bish, and Abner Brenner. Feb. 1955. 44p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ELECTRODEPOSITION AND ELECTRO-CHEMICAL TREATMENTS. Contract AF 33(616)-53-11.

Numerous non-aqueous solutions were investigated in an attempt to electrodeposit titanium. Some work was also done with zirconium. Ether solutions containing halides, hydrides, borohydrides, and organo-metallic compounds of titanium were the most promising solutions investigated.

A mixed type of bath containing both hydrides and borohydrides yielded titanium-aluminum alloys containing about six % titanium. Similar baths containing zirconium, instead of titanium, were studied. The zirconium baths gave alloy deposits containing up to 45% zirconium. New methods of preparation of titanium and zirconium borohydrides were developed. (auth)

6292 WADC-TR-54-555

Battelle Memorial Inst., Columbus, Ohio and Metal Trims, Inc., Youngstown, Ohio.

THE EXTRUSION OF TITANIUM. Alvin M. Sabroff, W. Maxwell Parris, and Paul D. Frost. PROJECT NO. 7351. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Mar. 1955. 76p. Contracts AF33(038)-3736 and AF33(600)-9203.

Extrusion tests were conducted on unalloyed titanium and the Ti-3Mn complex alloy to study the effects of extrusion temperature and die design and to evaluate various lubricants and die materials. Optimum mechanical properties were attained at extrusion temperatures in the alpha-phase region for unalloyed titanium and in the alpha-beta region for the Ti-3Mn complex alloy. The surface finish of round bars extruded with flat-face dies was very poor. Improved metal flow and surface finish were obtained with conical dies. The optimum die angle appeared to be about 130 degrees. Lubricants containing graphite, molybdenum disulfide, and mica produced acceptable surface finishes. The best results were obtained with these materials suspended in a Bentone grease. Titanium carbide, chromium carbide, and cobalt-base alloys showed promise as die materials. The carbides exhibited the least wear and less tendency toward seizing by the titanium. High-quality bars were extruded with these die materials and the Bentone lubricant mixture. (auth)

6293 WADC-TR-54-589

Michigan. Univ., Ann Arbor. Engineering Research Inst. THE INVESTIGATION OF THE MINOR PHASES OF HEAT-RESISTANT ALLOYS BY ELECTRON DIFFRACTION AND ELECTRON MICROSCOPY. L. O. Brockway and W. C. Bigelow. May 1955. 78p. Project title: METALLURGY AND METALLIC MATERIALS. Task title: CORROSION AND HEAT-RESISTING ALLOYS. Contract AF33(616)-23.

The combined use of electron diffraction and electron microscopy provides a very sensitive method for the study of the minor phases of alloy systems. The current interest in the properties of heat-resistant alloys and their dependence on the minor phases formed under stress and high temperatures has led to the application of this method to the heat-resistant alloys. Various polishing and etching procedures have been examined to determine those which are best suited for providing the special surface preparations necessary for the success of the method. Using these procedures, the electron diffraction and electron microscopic techniques have been used in detailed studies of the development of minor phases in 16-25-6 and Inconel-X alloys during aging at 1200, 1400, and 1600°F. Preliminary studies of a similar nature have been made on S816 and low-carbon N-155 alloy. In addition, the oxide phase of a sintered aluminum product has been identified. (auth)

6294 AEC-tr-2189

HEATED INGOT CONTAINERS FOR EXTRUSION OF LIGHT AND FERROUS METALS. H. M. Hiller. Translated by K. S. Bevis from *Metall* 8, 923-9(1954). 13p.

Theoretical and practical considerations for the suitable use of heated ingot containers in extruding light and ferrous metals are discussed, particularly the effect of temperature stresses on the strain in the individual ingot container components in order of nature and size. Calculations must be made for a reduction of the load capacity in containers for processing light metals, owing to the temperature effect. An increase in the capacity is possible in containers for ferrous metals. Details of the variations in contraction pressure owing to temperature are amplified. Since the contraction pressure must be calculated for the operating temperatures, it appears that all containers, particularly those used for processing ferrous metals, are in mechanical danger during the extrusion operation. (auth)

6295

CREEP BEHAVIOR AT 300°C OF A GROUP OF PRECIPITATION-HARDENING ALLOYS BASED ON THE ALPHA COPPER-ALUMINUM PHASE. J. P. Dennison (Univ. Col Swansea). *J. Inst. Metals* 83, 465-71(1955) July.

The creep, creep-rupture, and hot-tensile characteristics of six precipitation-hardening alloys based on the α copper-aluminum phase have been examined at 300°C. Specimens tested in the solution-treated, slowly cooled, and aged states have been subjected to detailed metallographic examination. Alloys containing cobalt, iron, and nickel, which exhibited a form of discontinuous precipitation at the grain boundaries at normal ageing temperatures, showed strain-induced boundary precipitation during test. In these cases a reduction in creep ductility ensued, which was generally associated with internal cracking. For such alloys the slowly cooled state gave the best combination of properties. Alloys containing titanium or zirconium showed a high ductility at all strain rates. The principal effects of precipitation before test were to reduce the period and extent of transient creep and to favor the development of fracture. (auth)

6296

THE EQUILIBRIUM DIAGRAM OF THE SYSTEM NICKEL-TITANIUM. D. M. Poole and W. Hume-Rothery (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Inst. Metals* 83, 473-80(1955) July.

The equilibrium diagram of the system nickel-titanium has been investigated above 900°C by thermal, microscopical, and x-ray methods. The addition of titanium to nickel produces a marked depression of the liquidus and solidus curves, which sink to a eutectic at 1304°C, the solid phases being the solid solution in nickel and the phase Ni_3Ti . The latter is of almost fixed composition and gives rise to a pronounced maximum on the liquidus at 1380°C. The solid solution in nickel remains supersaturated even after long times of annealing at 1000°C, and it is probable that the true equilibrium curve was not obtained. At 1118°C, there is a eutectic of Ni_3Ti and a phase of slightly variable composition based on the equiatomic ratio NiTi , which gives rise to a maximum on the liquidus curve at 1310°C. The liquidus then falls to 984°C, at which temperature the phase NiTi_2 , of almost fixed composition, is formed by a peritectic reaction. At 942°C there is a eutectic horizontal of NiTi_2 and the solid solution of nickel in β -titanium; above this both solidus and liquidus rise steeply to the melting point of titanium, which is estimated as 1680°C. Some lattice-spacing data are included. (auth)

6297

A STUDY OF THE TITANIUM-GERMANIUM SYSTEM IN THE REGION 0 TO 11 ATOMIC PER CENT GERMANIUM.

M. K. McQuillan (Imperial Chemical Industries, Ltd., Birmingham, England). *J. Inst. Metals* **83**, 485-9(1955) July.

The system titanium-germanium has been examined by micrographic methods in the range 0 to 11 at. % germanium, at temperatures from 500 to 1500°C. Germanium is found to cause a slight elevation of the transformation temperature of titanium, a peritectoid reaction in which β titanium reacts with the compound Ti_3Ge_3 to form α -titanium occurring at $897^\circ \pm 3^\circ C$. The compound Ti_3Ge_3 is formed from the melt by a eutectic reaction at $1410^\circ \pm 10^\circ C$. Anomalous structures have been observed as a result of heating as-cast alloys in the ($\alpha + Ti_3Ge_3$) region. Their origin is discussed. (auth)

6298

EQUILIBRIUM RELATIONS AT 460°C IN ALUMINIUM-RICH ALLOYS CONTAINING 0-7% COPPER, 0-7% MAGNESIUM, AND 2.0% SILICON. H. J. Axon (Univ. of Manchester, England). *J. Inst. Metals* **83**, 490-2(1955) July.

The equilibrium isothermal at 460°C is given for quaternary alloys rich in aluminum and containing 0 to 7 wt. % copper, and constant (2.0 wt. %) silicon. The results are related to previously published diagrams for alloys containing 1.2% silicon and 0.6% silicon, and the form of the aluminum-rich solid-solution field at 460°C is evaluated. (auth)

6299

MECHANICAL TWINNING IN MOLYBDENUM. R. W. Cahn (Univ. of Birmingham, England). *J. Inst. Metals* **83**, 493-6 (1955) July.

Molybdenum was found to twin by the same mechanism as iron, when single crystals were compressed by impact at the temperature of liquid oxygen. The crystals were also very malleable under these extreme conditions. Twinned crystals contained large cracks which were probably nucleated at junctions of two twin bands. The orientation of the twinned lattice was determined by the x-ray precession method, which has distinct advantages over the Laue method for this purpose. (auth)

6300

TITANIUM DIOXIDE FROM BAUXITE SLUDGE. V. Damodaran and J. Gupta (National Chemical Lab. of India, Poona). *J. Sci. Ind. Research (India)* **14B**, 292-7(1955) June.

A detailed study has been made of the preparation of titanium dioxide of high purity and good texture from bauxite sludge by the sulfuric acid process. The chief difficulty in applying the well-known procedure for ilmenite is attributed to the presence of comparatively large amounts of alumina in the sludge. A method has been worked out in which the sludge is first upgraded by leaching out a part of the iron and aluminum oxides with hydrochloric acid, and subsequently removing most of the alumina from the sulfate solution as potassium alum, which forms a useful by-product of the process. The main solution of titanium sulfate is then treated in the conventional way to give titanium dioxide in an overall yield of 80%. (auth)

6301

INERT-GAS WELDING IN THE AIRCRAFT INDUSTRY.

J. M. Thompson, Jr. (General Dynamics Corp., Fort Worth, Texas). *Welding J. N.Y.* **34**, 635-40(1955) July.

The inert-gas welding of aluminum, magnesium, titanium and stainless steel aircraft parts is discussed. Applications of inert-gas-shielded arc welding and use of consumable electrodes especially in the field of titanium welding are

presented. Various other applications of inert gases in the industry as well as uses for atomic hydrogen welding are mentioned. A series of photographs show various jigs and fixtures and some of the typical parts that are manufactured by inert-gas welding process. (auth)

6302

TITANIUM ALLOY WELDABILITY AND CORRELATED METALLURGY. H. L. Meredith and C. W. Handova (North American Aviation, Inc., Downey, Calif.). *Welding J. N.Y.* **34**, 657-72(1955) July.

Two proprietary high-strength titanium alloys were developed for the purpose of finding a weldable material with properties equal to that of the 8% manganese titanium alloy. The 8% manganese titanium alloy's mechanical properties at 700°F were considered to be good but the alloy's weldability was found to be unsatisfactory. One of the proprietary alloys was an all-alpha titanium alloy; the second was an alpha-beta titanium alloy. (auth)

6303

SOME STUDIES OF Al-Cu AND Al-Zr SOLID STATE BONDING. Samuel Storchheim (Sylvania Electric Products, Inc., Bayside, N. Y.). *J. Metals* **7**, 891-4(1955) Aug.

Solid state bonding of aluminum to copper and aluminum to zirconium was studied as a function of temperature, pressure, and time at pressure. The results indicated that good bonds could be obtained between aluminum and copper at the temperatures investigated. The excellent bond strengths attained between aluminum and zirconium indicate that the system bears further investigation. With this system, it is possible to develop bond strengths between the two metals which are greater than aluminum itself. (auth)

6304

ARC-CAST MOLYBDENUM. PART I. BETTER HIGH TEMPERATURE PROPERTIES. *Iron Age* **176**, No. 5, 79-81 (1955) Aug. 4.

6305

ARC-CAST MOLYBDENUM. PART II. HOW TO WORK (DRAW, MACHINE OR WELD). *Iron Age* **176**, No. 6, 95-7 (1955) Aug. 11.

Methods for fabricating arc-cast molybdenum and molybdenum alloys are discussed. Included are discussions of the tools, the buffing practices, and the cleaning solutions to be used. (B.J.H.)

6306

TITANIUM PREPARED BY A NON-KROLL PROCESS. Naoto Kameyama, Shun-ichi Satoh, Minoru Awata, and Shigeto Yamaguchi. *J. Sci. Research Inst. (Tokyo)* **49**, 35-8 (1955) Mar.

A chemical process for producing titanium other than the conventional methods is described. Identification of titanium formed by this chemical process was carried out by means of electron diffraction. The diffraction patterns characteristic of the titanium crystals obtainable by chemical processes were exhibited in the present study. These diffraction patterns will be of use for the identification of titanium prepared by some other chemical process. (auth)

6307

THE OXIDATION OF IRON-NICKEL ALLOYS. R. T. Foley (General Electric Co., Schenectady, N. Y.) and J. U. Druck and R. E. Fryxell (General Electric Co., Pittsfield, Mass.). *J. Electrochem. Soc.* **102**, 440-5(1955) Aug.

The high temperature (600° to 900°C) oxidation of an iron-

nickel alloy containing 42% nickel has been studied with the objective of formulating the mechanism of reaction. The rate was determined gravimetrically. Reaction products were examined by means of metallographic and electron diffraction techniques, as well as chemical analyses after stripping. The temperature dependence of the parabolic oxidation rate constant follows the Arrhenius equation with the parameters dependent on the method of surface preparation. The oxide film, upon cooling, possesses a two-phase structure consisting of a nickel ferrite (next to the alloy) and Fe_2O_3 . Differences in activation energies and oxidation rates are explained on the basis of diffusion through ferrite structures of a varying percentage of nickel. (auth)

6308

HIGH TEMPERATURE CORROSION RATES OF SEVERAL METALS WITH NITRIC OXIDE. Milton Farber, and Donald M. Ehrenberg (California Inst. of Tech., Pasadena). *J. Electrochem. Soc.* 102, 446-53(1955) Aug.

An experimental study has been made of the high temperature corrosion rates of various metal filaments with nitric oxide. Corrosion rates have been determined for iron, tantalum, tungsten, molybdenum, nickel, copper, silver, and the alloys Inconel, and stainless steel. The temperature range included temperatures from 800 to 2000°K. The metals, in order of decreasing corrosion resistance, are Inconel, 25-20 stainless steel, molybdenum, nickel, tantalum, 18-8 stainless steel, tungsten, iron, and copper. (auth)

6309

THE PRODUCTION OF ZIRCONIUM CHLORIDE FROM AUSTRALIAN ZIRCON SANDS. I. E. Newnham, Eleanor Rutherford, and A. G. Turnbull (C.S.I.R.O., Melbourne, Australia). *Australian J. Appl. Sci.* 6, 218-23(1955) June.

A simple and efficient technique for converting Australian zircon sand to zirconium chloride is described. The method, which is based on that originally developed by Kroll, is specifically designed for use in connection with small pilot plants where pound-scale quantities of zirconium chloride are required. Major items of equipment are a carbide tube resistor furnace, and a "Monel" metal chlorinator. Power for the carbon tube furnace is supplied by a 25 kva transformer and an autotransformer controller. (auth)

6310

ON THE ELECTROCHEMICAL SERIES OF METALS IN FUSED ALKALI FLUORIDES. Kai Grjotheim. pp. 131-6 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issuire, 1955. 347p. (In French)

The present investigation deals with an experimental determination at 850°C of the relative position in the electrochemical series of aluminum, manganese, chromium, and nickel dissolved in the fused eutectic mixture of sodium and potassium fluorides. The experiments were of a preliminary character. Their purpose was to obtain information about the possibility of using Daniell-type cells for electrochemical measurements in fluoride melts, when the diffusion potential of the liquid junction was neglected. The attempt seems promising and the method may be extended to other systems. (auth)

6311

THE SUBHALIDE DISTILLATION OF ALUMINIUM. P. Gross. pp. 167-71 of CONGRES INTERNATIONAL DE

L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954.

TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issuire, 1955. 347p. (In English)

The basic principles of evaporation of aluminum as subhalide and of the production of pure aluminum by this method are considered. The equilibria involved are discussed. Some of these are also of importance for the production of aluminum from its alloys by other processes. Methods which have been used for the measurement of these equilibria are described. (auth)

6312

APPLICATION OF A NEW PHYSICAL METHOD, KNOWN AS "ZONE MELTING," TO THE EXTREME PURIFICATION OF ALUMINIUM AND EXTENSION OF THE METHOD TO OTHER MATERIALS. Georges Chaudron. pp. 179-83 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issuire, 1955. 347p. (In French)

The new method consists in melting by high frequency a small zone of a long aluminum bar with a very slow advance of the molten zone: the impurities migrate towards the end region of the bar, its starting end being purified. After nine passes of the molten zone through a 99.997% aluminum bar 40 cm long, the purified $\times 30$ cm zone reach a purity not far from 99.9995%. (auth)

6313

ANALYSIS OF IMPURITIES IN SUPER-PURITY ALUMINIUM. Philippe Albert, Frédéric Montariol, and Michel Caron. pp. 187-9 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issuire, 1955. 347p. (In French)

The analysis of impurities in super purity aluminum has been made by various methods. The authors have developed new analytical methods by means of radio-elements which have allowed them to corroborate their former results; these methods have been used especially for the analysis of final traces of impurities in aluminum refined by the molten zone method. (auth)

6314

MICRO-DETERMINATION OF CARBON IN SUPER-PURITY ALUMINIUM. Philippe Albert, Andrée Nouaille, Georges Chaudron, and Pierre Sue. pp. 191-3 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issuire, 1955. 347p. (In French)

In a previous work, a method of micro-determination of carbon in iron by measuring the β activity of the radio-nitrogen was described. The possibility of extending the determination to other metals had been considered. In the present work, carbon has been determined in varieties of super-purity aluminum, in particular metal refined by the molten-zone method. (auth)

6315

TEXTURAL PHENOMENA OCCURRING DURING THE PRECIPITATION OF HOMOGENIZED Al-Zn-Mg ALLOYS. Paul Brenner and Margarete Schippers. pp. 219-29 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In French)

Al-Zn-Mg alloys (super-purity aluminum, up to 8.5% Zn, 3.75% Mg) have been prepared by continuous casting so as to study the micrographic structure after decomposition of the solid solution. After heating at 500°C (932°F) and slowly cooling, the occurrence of a fine network located at the grain boundaries, and the formation of numerous intragranular veins have been observed, together with the precipitation of the concentrated phase at the original grain boundaries of the cast structure. These veins can also be observed after quenching followed by tempering, but in general more weaker than the precipitation at the grain boundaries. (auth)

6316

ROLLING AND RECRYSTALLIZATION TEXTURES OF ALUMINIUM PLATES. Wolfgang Bunk. pp. 231-6 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In French)

The research work related in this paper was carried out at the University of Göttingen with the aid of an x-ray goniometer with a counting tube which offers many advantages compared with the old photographic methods. Industrial hot-rolled aluminum (Al 99.3%, Fe 0.4%, Si 0.25%, Zn 0.04%) 8 mm ($\frac{1}{3}$ ") thick was used as basis metal. Specimens submitted to different amounts of cold work and heat treatments (annealing before cold rolling or intermediate annealing) were taken from this blank. A detailed description of the textures observed is given with numerous illustrations. (auth)

6317

ABNORMAL GRAIN GROWTH OF SOME ALUMINUM ALLOYS. Thomas L. Fritzlen. pp. 237-46 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In English)

Grain coarsening of aluminum alloys has been the subject of numerous studies in the laboratory and of investigations in the factory. From the practical point of view, it is fortunate that the alloys most frequently used contain enough impurities to prevent grain coarsening from being troublesome. However, there are still cases when unusual grain coarsening sets difficult problems. These problems are examined and discussed in the light of recent tests. (auth)

6318

X-RAY STUDY OF THE INFLUENCE OF COLD ROLLING AFTER QUENCHING UPON PRECIPITATION PHENOMENA IN THE Al-Cu ALLOY WITH 4% Cu. Rene Graf. pp. 247-8 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A

PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In French)

The x-ray study of polycrystalline specimens shows that cold-working greatly accelerates the appearance of the θ' and θ precipitates. This makes it possible to explain why hardness curves indicate a more rapid softening as the cold-working rate is increased. (auth)

6319

RELATIONSHIP BETWEEN THE HEAT TREATMENT OF Al-Mg-Si ALLOYS AND THE CHEMICAL BEHAVIOUR OF SILICON IN THESE ALLOYS. Marcel Tournaire and Martial Renouard. pp. 249-56 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In French)

In 1952, a method of analysis was proposed permitting—at least to a certain extent—distinction between the different states of silicon in aluminum-magnesium-silicon alloys. This method is based on the attack of the alloy with dilute hydrochloric acid. The complementary work now described has allowed confirmation of the good correlation between analysis and mechanical properties and specify—to some extent—the reactions of the alloy phases with dilute hydrochloric acid. Although it is not yet possible to estimate exactly the main phases of aluminum-magnesium-silicon alloys, it is hoped that the systematic study of binary and ternary alloys will make it possible. It now appears that the method can yield information in some cases, which could be obtained far less easily by other processes. (auth)

6320

STUDY OF THE QUENCHING OF A LIGHT ALLOY WITH REFERENCE TO ITS ELASTIC PROPERTIES. Robert Cabarat. pp. 271-3 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In French)

A new dynamic method of measuring the modulus of elasticity and the internal friction is described. In an application of this method, the author shows the effects of quenching—against time—on an aluminum-zinc alloy, with reference to its elastic properties. (auth)

6321

THE CREEP PROPERTIES OF ALUMINIUM ALLOYS WITH REFERENCE TO FUTURE USES OF ALUMINIUM AT ELEVATED TEMPERATURES. David E. Thomas. pp. 275-81 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In English)

A review is presented of the existing information about the creep properties of aluminum alloys, and a discussion is given of what extent this information is likely to be adequate to meet the demands which might be made in connection with future trends in applications involving the use of

aluminum alloys at elevated temperatures. It is shown that while there exists a great deal of information about the creep of the so-called high-temperature alloys, very little information exists concerning the long term creep characteristics of the alloys of the aluminum-magnesium types. (auth)

6322

A NEW METHOD FOR THE STUDY OF ALUMINIUM AND ITS ALLOYS BY ELECTRON DIFFRACTION. Jean-Jacques Trillat. pp. 283-8 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In French)

It is possible to record continuously the structural changes of aluminum alloys and observe chemical reactions with electron diffraction apparatus. Examples are given for Al-Cu alloys, showing clearly the formation of compounds such as CuAl_2 or CuAl , and the oxidation of aluminum. This method may be extended to the study of other light alloys as well as to many other problems. (auth)

6323

LIQUATION AND EQUILIBRIUM DIAGRAMS: APPLICATIONS TO THE DIAGRAM OF Al-Fe-Si ALLOYS. Marcel Armand. pp. 305-27 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In French)

The liquation method for establishing constitution diagrams depends essentially on slowly cooling the molten alloys and sampling at different stages of solidification. This method of operating has two main advantages:

- (1) The phases of the primary deposit are obtained in the form of large crystals, clearly defined, which allows the direct study of their properties;
- (2) The analysis of the liquid gives directly—and in one operation only—important parts of the outline of the characteristic lines of the diagram (eutectic or peritectic lines). This method is general and its systematic application will no doubt allow great advances in knowledge, as is shown by an example of its application to the study of the Al corner of the Al-Fe-Si diagram. (auth)

6324

ALUMINIUM-COPPER-CADMIUM ALLOYS. E. A. G. Liddiard and H. K. Hardy. pp. 329-38 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME I (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. I). Edited by the Society of Publication and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 347p. (In English)

The history of the development of the new aluminum-copper-cadmium series of alloys is outlined, followed by sections dealing with the effects of variations in composition. Melting, casting and working techniques, recommended heat treatment, corrosion and stress corrosion behavior, and typical properties are given where these are known. Particular applications are suggested. (auth)

6325

INFLUENCE OF THE SURFACE STATE ON THE CORRO-

SION OF ALUMINIUM. Pierre A. Jacquet. pp. 7-22 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME II (International Congress of Aluminum held at Paris June 14-19, 1954. Vol. II). Edited by the Society of Publications and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 343p. (In French)

The tests undertaken with various commercial qualities of aluminum, cold worked and annealed, are described in order to compare the superficial attack of mechanically and electrolytically polished specimens in contact with different media (salt spray, alkaline and acid solution). The progress of corrosion was observed with a microscope, and in the case of alkaline solutions the discussions of the observations suggests that some of the results published in the literature should be revised as the part played by the initial surface condition has not been sufficiently considered by the authors. (auth)

6326

INFLUENCE OF PURITY ON THE CORROSION OF SUPER-PURITY ALUMINIUM. Frederic Montariol. pp. 23-6 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME II (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. II). Edited by the Society of Publications and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 343p. (In French)

Super-purity aluminum of conventional purity (99.99 and 99.998%) submitted to corrosion in 15% hydrochloric acid exhibits a very strongly marked preferential attack at the boundaries. In this work, the study has been carried out with aluminum of greater purity. (auth)

6327

EARING IN DEEP-DRAWING OF ALUMINIUM AND POSSIBLE REMEDIES. Raymond Chevigny. pp. 109-25 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME II (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. II). Edited by the Society of Publications and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 343p. (In French)

Continuous casting causes a more definite tendency towards 90° earing in the rolling of aluminum, a greater susceptibility to transformation factors and more scattered results than casting in molds. Homogenization has a leading influence on the anisotropy of the sheets obtained by continuous casting, while it is just a secondary factor for the sheets obtained from molds. The anisotropy of sheets is closely connected to the distribution of the impurities in the cast slabs, the orientations of the crystals of the cast slabs seem to be a secondary factor. A certain casting device confers the advantages of conventional continuous casting, while yielding products which are not more prone to earing than those produced in ingot molds. (auth)

6328

THE FORMATION OF EARS IN THE DRAWING OF ALUMINIUM SHEET. Gustav Siebel. pp. 127-37 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME II (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. II). Edited by the Society of Publications and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 343p. (In French)

Study was made of the various factors having an influence

on the formation of ears during the drawing of aluminium sheet, and research on the conditions favoring a nearly isotropic behavior of these sheets. From the point of view of earing, casting in ingot molds is more favorable than continuous casting. The rolling temperature has a very strong effect on earing. The conditions in which the 0 and 90° positions of earing appear and the 45° position are stated. Low rolling temperatures favor the 0 and 90° positions of earing, while high temperatures favor the 45° position. Earing during drawing can be greatly reduced by cross rolling. (auth)

6329

ANISOTROPY OF PURE ALUMINIUM SHEET—EARING IN DEEP-DRAWING. Guy Trapiel. pp. 139-50 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME II (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. II). Edited by the Society of Publications and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 343p. (In French)

Rolling ingots in aluminum and light alloys are always cast now by the continuous casting process. This has a serious drawback as it produces in pure aluminium an anisotropy giving rise to the troublesome phenomenon of earing during drawing. A new continuous casting process consists in spraying on the ingot—below the spray ring—water atomized by air under pressure, which is vaporized in contact with the metal. Cooling is slower than in ordinary continuous casting and it assures sufficient isotropy to suppress completely the formation of ears during drawing. (auth)

6330

THE WELDING OF ALUMINIUM IN INERT ATMOSPHERE. Maurice Michaud. pp. 157-8 of CONGRES INTERNATIONAL DE L'ALUMINIUM TENU A PARIS DU 14 AU 19 JUIN 1954. TOME II (International Congress of Aluminum held in Paris June 14-19, 1954. Vol. II). Edited by the Society of Publications and Documentation of Light Alloys. Paris, R. Blanchard, 61 Rue de la Tombe-Issoire, 1955. 343p. (In French)

Welding with a shield of inert gas using a non-consumable electrode or a consumable electrode has marked a notable progress in the processes of joining light metals. During the meeting, Liquid Air will show a new film on these two processes. (auth)

6331

UNDERWATER CUTTING AND WELDING MANUAL. Bureau of Ships, Washington, D. C. Available from GPO as NAVSHIPS 250-692-9 for \$0.55. 106p.

6332

ALLOYS FOR THE CHEMICAL PROCESS INDUSTRIES. J. Z. Briggs (Clitmax Molybdenum Co., New York). *Ind. Eng. Chem.* 47, 1513-16(1955) Aug.

The effects of molybdenum additions on the corrosion resistance of austenitic Cr-Ni steels, silicon irons, and Ni-base alloys are outlined. Molybdenum improved the corrosion resistance of several ferrous and nonferrous alloys. (C.W.H.)

PHYSICS

6333 NP-5708

Continental Oil Co. Central Research Labs., Ponca City, Okla.

DEVELOPMENT AND EVALUATION OF A GREASE FOR

—100° TO +350°F. QUARTERLY REPORT NO. 1 FOR PERIOD MARCH 15—JUNE 15, 1955. E. W. Nelson, W. W. Woods, C. R. Bergen, and B. P. Scott. June 29, 1955. 18p. Contract AF33(616)-2364, Supplemental Agreement No. S2(55-987).

Monthly Report No. 3 covering work of the period May 15 to June 15, 1955 is incorporated in this report and will not be submitted separately.

The development of a grease with a high-load carrying capacity that is operational over a -100° to 350°F temperature range was studied. It was proposed that such a grease would be made by forming a fluid dispersion of colloidal calcium carbonate in a suitable base oil, followed by chemical interlinking of the dispersed particles to form the grease structure. Two types of base oils, silicate esters and aliphatic diesters, were found, which appeared to have the necessary thermal and oxidative stability along with the requisite solvency for the dispersing agent, an alkyl benzene sulfonate. It was decided to utilize an aliphatic diester, di-2, ethyl hexyl azelate for initial development. Experimentation showed 3-methyl glutaric acid to be a superior coupling agent for interlinking the dispersed particles into a grease structure. Greases so produced had dropping points of above 450°F and easily met the low temperature torque, bleeding and evaporation tests as outlined in Exhibit A. In order to meet the worked stability specifications, it was found necessary to incorporate a stabilizing additive. Either DC510 silicone fluid or Acryloid 710 was effective, but the latter is somewhat superior in that it is effective at lower concentrations and is not prone to cause separation. A preliminary search was recorded in which certain zinc mahogany sulfonates were found to reduce the loss due to washout of the contract grease; however results were erratic, and this was subsequently traced to instability of the effective components. (auth)

6334 UCRL-2988

California, Univ., Berkeley. Radiation Lab. **TREATING CONCRETE SURFACES WITH PARAFFIN.** Albert E. Salo. May 18, 1955. 5p. Contract W-7405-eng-48.

A penetrating application of paraffin seals the pores of surfaces and makes decontamination relatively easy because it reduces absorption of liquids that might carry radioactivity. Molten paraffin (mp 125°F) is applied to a clean concrete surface that has been heated to about 500°F. Penetration depths of 1/4 inch are usual, but penetration may range up to 3/4 inch. Pore spaces in the concrete are sealed when the paraffin cools. (auth)

6335 UCRL-4462

California, Univ., Livermore. Radiation Lab. **WAVE PROPAGATION IN CONTINUOUSLY LOADED WAVEGUIDES. I. CONDITIONS FOR PROPAGATION OF PURE ELECTRIC AND MAGNETIC WAVE TYPES IN A CYLINDRICAL SYSTEM CONTAINING DIELECTRIC OR MAGNETIC BOUNDARIES.** J. F. Waddell. Feb. 1955. 31p. Contract W-7405-eng-48.

General conditions are derived for the propagation of waves of the purely electric and magnetic types in a generalized cylindrical system of conducting, dielectric, or magnetic boundaries subject only to the restriction that the media are lossless, and no more than two in number. An example is worked out to demonstrate the general nature of the waves propagated. (auth)

6336 WADC-TR-54-418

Wright Air Development Center. Materials Lab.,
Wright-Patterson AFB, Ohio.

PROCEDURE FOR DETERMINING VAPOR PRESSURES
OF MATERIALS OF LOW VOLATILITY. O. M. Ballentine.
Feb. 1955. 20p. Project title: HYDRAULIC FLUIDS.
Task title: AIRCRAFT LUBRICATING GREASES.

An apparatus has been developed for determining absolute vapor pressures of both liquids and solids that exhibit low volatility characteristics. This method has the following advantages: obtaining vapor pressures up to 1000°F, requiring a minimum of operator's time (approximately one hour), relative simplicity and high degree of accuracy in final results. The method employs Knudsen's equation, based on the kinetic theory of gases, in which the weight loss of material per unit time is proportional to the vapor pressure of the material. (auth)

6337

PRINCIPAL PROBABILITY OF SPLITTING OF BEAMS OF CHARGED PARTICLES WITH VARIOUS POLARIZATIONS IN A MAGNETIC FIELD. V. V. Vladimirovskii. Doklady Akad. Nauk S.S.S.R. 102, 1099-1100(1955) June 21. (In Russian)

6338

ISOTOPIC COMPOSITION OF METEORITIC HYDROGEN. George Edwards (Inst. for Nuclear Studies, Chicago). Nature 176, 109-11(1955) July 16.

Methods of isolation and determination of protons and deuterium in meteorites, and of preparation of meteorites for analysis are described. The ratios of deuterium to hydrogen in various chondrite and iron meteorites are reviewed. (B.J.H.)

6339

TIME INTERVAL BETWEEN NUCLEOGENESIS AND THE FORMATION OF METEORITES. G. J. Wasserburg (Inst. of Nuclear Studies, Chicago) and R. J. Hayden (Argonne National Lab., Lemont, Ill.). Nature 176, 130-1(1955) July 16.

A lower limit to the time interval between the formation of the elements and of meteorites was set at $t \geq 0.41 \times 10^9$ yr on the basis of Xe^{129} content in meteorites. (B.J.H.)

ASTROPHYSICS

6340

ON THE ISOTOPES OF METEORITIC ARGON. A. B. Trofimov and K. G. Rik (Vernadskii Inst. of Geochemistry and Analytical Chemistry). Doklady Akad. Nauk S.S.S.R. 102, 911-14(1955) June 11. (In Russian)

COSMIC RADIATION

6341 AECU-3060

New York Univ., New York. Coll. of Engineering.
HIGH ALTITUDE COSMIC RAY NEUTRON INTENSITY VARIATIONS. Robert K. Soberman. July 1, 1955. 110p. Cosmic Ray Project. Sponsored by ONR and AEC under Contract N6onr279 TO 2.

Three groups of balloon flights carrying boron tri-fluoride counters were made from geomagnetic latitudes 10.1°N, 55.1°N and 88.6°N. From the data obtained, curves of neutron intensity vs. atmospheric depth for depths less

than 700 mb are plotted. The mean absorption lengths for neutrons in the equilibrium portion of the atmosphere were found to be $L(10.1^\circ) = 212 \text{ gm/cm}^2$, $L(55.1^\circ) = 164 \text{ gm/cm}^2$, and $L(88.6^\circ) = 164 \text{ gm/cm}^2$. The depths of the neutron intensity maxima were found to be $\Theta_{\text{max}}(10.1^\circ) = 120 \pm 5 \text{ mb}$, $\Theta_{\text{max}}(55.1^\circ) = 100 \pm 5 \text{ mb}$, and $\Theta_{\text{max}}(88.6^\circ) = 75 \pm 5 \text{ mb}$. From these results and those of other investigators, the variation of the mean absorption coefficient ($\mu = 1/L$) and the depth of the neutron intensity maximum are plotted as functions of the geomagnetic latitude. A family of curves of neutron intensity vs. atmospheric depth is drawn for geomagnetic latitudes at 10° intervals between 0 and 90°N and from this the low-energy neutron capture/cm²/sec by the $\text{N}^{14}(n,p)$ reaction in the atmosphere is calculated and plotted as a function of geomagnetic latitude. It is found that the observed neutron intensity varies by about 420% from 0 to 90°N. A value of $5.8 \times 10^{18} \text{ sec}^{-1}$ is obtained for the total number of low-energy neutrons captured in the atmosphere. (auth)

6342 NP-5715

Minnesota. Univ., Minneapolis.

THE LIGHT ELEMENTS IN COSMIC RAYS: A DOUBLE-SCINTILLATION-COUNTER EXPERIMENT (thesis). Leland S. Bohl. Dec. 1954. 47p. Cosmic Ray Project. Contract N6onr-246.

The charge spectrum of the primary cosmic rays in the light element region (Li, Be, and B) was investigated using the double scintillation counter technique. An upper limit of 0.4 was determined for the ratio of the flux of the light elements to that of medium elements (O, N, and C) in primaries. These results imply that the cosmic-ray beam transverses at most a few mean free paths and support the picture of cosmic rays having a galactic source and being only partially trapped within the galaxy. (C.W.H.)

6343 NP-5717

Minnesota. Univ., Minneapolis.

HIGH ENERGY PHENOMENA IN NUCLEAR EMULSIONS [thesis]. John E. Naugle. 1953. 96p. Cosmic Ray Project. Contract N6onr-246.

Four high energy interactions initiated by particles with charge greater than 2 have been investigated. At energies greater than 200 bev the observed multiplicity of meson production is in agreement with that predicted by the Fermi and the revised Heisenberg theories of multiple meson production. The angular distributions are consistent with those predicted by the Fermi theory. However, the observed inelasticity is lower than that predicted by the Fermi theory. The neutral to charged meson ratio has been measured in one of the interactions, giving a value of $.5 \pm .3$. The energies of 3 secondary particles from one of the interactions have been measured by analysis of the angular distributions of the showers which they initiate. There is a wide variation in the energy of the 3 shower particles. The energies of the electrons in the soft component of this same interaction have been measured. Using the energy of the electrons to determine the energy of the neutral mesons in the interaction, it is found that the energy of the neutral mesons is lower by a factor of 5 to 10 than the energy of the charged mesons. The mean free path for trident production in the emulsion has been measured for electrons with energy between 2 and 25 bev. The value obtained is $2.8 \pm .8 \text{ cm}$ of emulsion. This corresponds to a cross section 3 to 6 times larger than that predicted by theory. (auth)

6344

THE RATES OF PENETRATING SHOWERS AT SEA LEVEL. C. B. A. McCusker, J. G. Dardis, and B. G. Wilson (Dublin Inst. for Advanced Studies, Ireland). *Proc. Phys. Soc. (London)* **A68**, 585-90(1955) July 1.

The times of arrival of 17,665 local and 2,525 extensive penetrating showers have been recorded. The showers penetrated various thicknesses of lead from 17.5 cm to 97.5 cm. A variation of the rate of local showers with solar time which is correlated with the small diurnal pressure variations appears to be statistically established. This variation seems to have a much larger barometric coefficient than that derived from the large pressure changes associated with the weather. No significant variation of the rate of local showers with sidereal time was found. Possible variations of the rates of penetrating extensive showers with solar and with sidereal time are discussed. (auth)

6345

NUMERICAL CALCULATIONS ON THE FLUCTUATION PROBLEM IN CASCADE THEORY. J. W. Gardner, H. Gellman, and H. Messel (Univ. of Sydney, Australia). *Nuovo cimento* (10) **2**, 58-74(1955) July. (In English)

The problem of obtaining numerical results for the fluctuation problem in cascade theory is discussed. Results, using the electronic computer, Ferut, and desk calculating machines are presented for a model-test-run on the nucleon cascade in homogeneous nuclear matter. These are discussed in relation to an extensive program of computations for the physically important case of electron-photon cascades. (auth)

6346

STUDY OF THE ANISOTROPY OF COSMIC RAYS WITH NARROW ANGLE TELESCOPES. V. Sarabhai, N. W. Nerurkar, and P. D. Bhavsar (Physical Research Lab., Ahmedabad, India). *Proc. Indian Acad. Sci.* **41A**, 245-52 (1955) June.

Narrow angle, triple coincidence telescopes were used to observe the daily variation of meson intensity, which in turn provides information on the anisotropy of the primary radiations. Data show a considerable variation of meson intensity. (B.J.H.)

6347

ON THE POSITIVE TEMPERATURE EFFECT IN THE COSMIC RADIATION. H. Trefall (Imperial Coll. of Science and Technology, London). *Proc. Phys. Soc. (London)* **A68**, 625-31(1955) July 1.

The results of several underground measurements of the positive temperature effect are examined in order to obtain some information about the attenuation length of high-energy π mesons in air. It is shown that this quantity can hardly be smaller than the attenuation length of the primary component. If this is so, competition between disintegration and nuclear capture of the π mesons can account for but a very small part of the positive temperature effect which has been observed at sea level. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

6348 NRL-4553

Naval Research Lab. Optics Div., Washington, D. C. SPOT-WIDTH VARIATION IN WEISSENBERG X-RAY DIFFRACTION PATTERNS FROM SINGLE CRYSTALS. A. B. Wing. May 20, 1955. 9p. Project No. NR 694-040.

The variation in the base widths of single-crystal reflections in Weissenberg photographs is analyzed in terms of geometric, chromatic, and crystal lattice factors. It is shown to be feasible to construct curves for this variation which can be used for correcting visual estimates of the reflection intensities. This has been found essential for bringing the estimates into their proper relationship with the true intensity values. (auth)

6349

SUBMICROSCOPIC STRUCTURE DETERMINATION BY LONG WAVELENGTH X-RAY DIFFRACTION. Burton L. Henke and Jesse W. M. DuMond (California Inst. of Tech., Pasadena). *J. Appl. Phys.* **26**, 903-17(1955) July.

The theory of low-angle x-ray diffraction as applied in the long wavelength region for the determination of particle sizes and shapes and other structural features in the sub-microscopic size range is reviewed and the advantages to be gained by employing the longer x-ray wavelengths are emphasized. A new instrumental technique developed for the long wavelength range is described. (C.W.H.)

6350

ON THE STRUCTURES OF SOME COMPOUNDS OF THE PEROVSKITE TYPE. Harry L. Yakel, Jr. (Oak Ridge National Lab., Tenn.). *Acta Cryst.* **8**, Pt. 7, 394-8(1955) July 10.

X-ray powder diffraction patterns of a number of compounds and solid solutions of the type ABO_3 , where B is a transition metal element, have been recorded and interpreted. These substances all have perovskite-like structures, with characteristic lattice distortions and multiple unit cells which are a result of partial covalent bonding. Variations of structures with differing conditions of preparation are noted for $LaMnO_3$ and $CaMnO_3$, where the results of chemical analyses show that these variations accompany departures from stoichiometric composition. Solid solutions of $LaMnO_3$ and $CaMnO_3$ obey Vegard's rule, a decrease in unit cell volume being produced by the substitution of Ca^{+2} and Mn^{+4} ions in the $LaMnO_3$ structure. An unusual increase in unit cell volume is, however, observed when Sr^{+2} and Co^{+4} ions are substituted in the $LaCoO_3$ structure. (auth)

6351

CRYSTAL CHEMICAL STUDIES OF THE 5f-SERIES OF ELEMENTS. XXIV. THE CRYSTAL STRUCTURE AND THERMAL EXPANSION OF γ -PLUTONIUM. W. H. Zachariasen (Univ. of Chicago) and F. H. Ellinger (Los Alamos Scientific Lab., N. Mex.). *Acta Cryst.* **8**, Pt. 7, 431-3(1955) July 10.

γ -Plutonium is found to be orthorhombic with eight atoms in a unit cell of dimensions (at 235°C) $a_1 = 3.1587 \pm 0.0004$, $a_2 = 5.7682 \pm 0.0004$, $a_3 = 10.162 \pm 0.002$ Å. The calculated density is 17.14 ± 0.01 g.cm.⁻³. The space group is Fddd and the positions of the eight atoms are: (0, 0, 0), (0, $\frac{1}{2}$, $\frac{1}{2}$), ($\frac{1}{2}$, 0, $\frac{1}{2}$), ($\frac{1}{2}$, $\frac{1}{2}$, 0), ($\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{4}$), ($\frac{1}{4}$, $\frac{3}{4}$, $\frac{3}{4}$), ($\frac{3}{4}$, $\frac{1}{4}$, $\frac{3}{4}$), ($\frac{3}{4}$, $\frac{3}{4}$, $\frac{1}{4}$). Each plutonium atom is bonded to ten others at an average distance of 3.157 Å, four being at 3.026 Å, two at 3.159 Å and four at 3.288 Å. The mean linear coefficients of thermal expansion are found to be $10^6 \alpha_{[100]} = -19.7 \pm 1.0/^\circ\text{C}$, $10^6 \alpha_{[010]} = 39.5 \pm 0.6/^\circ\text{C}$, $10^6 \alpha_{[001]} = 84.3 \pm 1.6/^\circ\text{C}$. (auth)

ELECTRICAL DISCHARGE

6352 AWRE-O-11/55

Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.

DEGASSING OF VACUUM SYSTEMS BY IONISATION

BOMBARDMENT. A. J. Martin. May 2, 1955. 8p.

Experiments on the use of a high-voltage glow discharge for outgassing components in a vacuum system are described. Both direct and alternating discharge experiments were conducted; alternating current was found to give a more uniform discharge and electrode configurations leading to the best results in the particular vacuum chamber used are described. (auth)

6353 NP-5710

Office of Naval Research, Washington, D. C.

SPARK BREAKDOWN IN UNIFORM FIELDS. Leonard B. Loeb, Univ. of California. July 1954. 148p.

Sixth in a series sponsored by the Physics Branch, ONR.

A complete discussion is given of spark breakdown in uniform fields. Included are such topics as sparking criterion and sparking mechanisms, the growth of a Townsend discharge, the Townsend discharge and Paschen's law, the effect of electron attachment on spark breakdown thresholds, statistical fluctuations of a Townsend discharge and time lags, visual manifestations of sparks, and a complete discussion of the streamer mechanism of sparks. (B.J.H.)

6354 ORNL-1916

Oak Ridge National Lab., Tenn.

RELAY INSULATION STUDIES. O. B. Rudolph. June 7, 1955. 14p. Contract W-7405-eng-26.

This report deals with the use of small hermetically sealed relays in a type of service where extremely high insulation resistance is necessary, the difficulties encountered, and corrective techniques employed. (auth)

6355 AEC-tr-2194(p.A1-2)

QUALITATIVE SPECTRUM ANALYSIS WITH EXCITATION BY A POWERFUL PULSE DISCHARGE (condensation). E. I. Vorontsov. Translated from *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* 18, 262(1954). 2p. Available from Columbia Technical Translations, White Plains, N. Y.

The use of a heavy pulse discharge for spectrum excitation is suggested. It was found that wandering of the discharge affects the intensity of the spectrum and thus also affects reproducibility of the results. (B.J.H.)

6356 AEC-tr-2194(p.B1-3)

SPECTRAL EXCITATION IN THE CHANNEL OF A SPARK DISCHARGE (condensation). S. L. Mandel'shtam. Translated from *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* 18, 261-2(1954). 3p. Available from Columbia Technical Translations, White Plains, N. Y.

The density and temperature of the gas in spark discharges were investigated, and results were in agreement with the hydrodynamic theory of channel development. The variation of brightness of different spark excited spectral lines with time was also investigated, and a theoretical analysis of conditions of excitation and ionization in the spark channel was made. (B.J.H.)

6357 AEC-tr-2194(p.C1-2)

ON THE ELECTRIC EROSION OF METALS IN A SPARK DISCHARGE (condensation). Ya. (Ia.) D. Raibaum and A. G. Krest'ianinov. Translated from *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* 18, 258(1954). 2p. Available from Columbia Technical Translations, White Plains, N. Y.

The atomization of various metals in spark discharges was investigated. It was found that erosion is fairly stable for each metal, depending primarily on the character of the discharge. It was shown that the closest correlation between amount of corrosion and thermal constants exists

between ΔH , the difference in heat content of the solid and gaseous states, and the characteristic temperature of the metal. (B.J.H.)

6358 AEC-tr-2194(p.D1-2)

CERTAIN CHARACTERISTICS OF THE STRUCTURE OF ARC-DISCHARGE CLOUDS (condensation). M. M. Noskov and G. P. Skorniyakov (Skorniakov). Translated from *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* 18, 257(1954). 2p. Available from Columbia Technical Translations, White Plains, N. Y.

Some of the characteristics of the structure of arc-discharge clouds was studied, specifically, the intensity distribution of individual lines in the arc cloud region using various electrodes, the influence of the counterelectrode material on excitation conditions, and transfer of the electrode material during the discharge. Various conclusions from the study are presented. (B.J.H.)

6359 AEC-tr-2194(p.G1-2)

SPECTROSCOPIC INVESTIGATION OF THE DISTRIBUTION OF ELECTRON SPEEDS IN THE POSITIVE COLUMN OF A DISCHARGE (condensation). V. M. Zakharova and Yu. (Iu.) M. Kagan. Translated from *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* 18, 254(1954). 2p. Available from Columbia Technical Translations, White Plains, N. Y.

Information was obtained on the distribution of electron speeds through a spectrum analysis of the discharge through a gas. Relative intensities of the lines of the series were measured, and a method of calculating electron speed distributions was outlined. Observations were made on the positive column of the discharge in a mixture of sodium and helium vapors. (B.J.H.)

6360 AEC-tr-2194(p.H1-4)

DETERMINING THE CONCENTRATION OF NORMAL ATOMS IN A DISCHARGE [condensation]. A. M. Shukhtin. Translated from *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* 18, 253-4(1955). 4p. Available from Columbia Technical Translations, White Plains, N. Y.

Measurements were made of the normal atom concentrations in the positive column of a discharge through cesium and mercury vapor by the "hook" method. Ratios of the number of normal atoms under discharge conditions to the number of normal atoms in the absence of a discharge are tabulated, and an analysis of the data is made. (B.J.H.)

6361 ATI-142948

INVESTIGATION OF THE INITIAL STAGE OF SPARKING. V. V. Mezhuyeva, I. S. Stekolnikov, and A. Z. Efendiev. Translated from *Zhur. Tekh. Fiz.* 20, 308-26; 353-62(1950). 60p. Available from Charles A. Meyer and Co., Inc., Nyack, N. Y. (F-TS-7335-RE)

A detailed discussion is first given on the experimental investigations made to obtain data on the conditions within spark discharges. Ten different spark generator circuits that were used are described fully. All spark potentials were recorded by an oscillograph, and circuits are given which record the current in the spark. The results obtained from each spark generator arrangement are analyzed completely. (B.J.H.)

ELECTRONS

6362

ON THE SCATTERING OF HIGH ENERGY ELECTRONS.

G. N. Fowler (Univ. of Manchester, England). Proc. Phys. Soc. (London) **A68**, 559-64(1955) July 1.

The effect of the finite nuclear size on the scattering of high-energy electrons depends upon the ratio of the small to the large radial Dirac function inside the nuclear charge distribution. An approximate expression for this ratio is given, valid for energies of the order of 150 Mev. The result is used to discuss the model independence of the scattering for the case of uniform and shell charge distributions. (auth)

6353

ON THE SPIN PARAMAGNETISM OF A FREE ELECTRON GAS. II. B. Donovan (Northern Polytechnic, London), A. B. Lidard (Atomic Energy Research Establishment, Harwell, Berks, England), and N. H. March (Univ. of Sheffield, England). Proc. Phys. Soc. (London) **A68**, 644-7(1955) July 1.

This note describes the application of a new distribution function to the problem of calculating paramagnetic susceptibility as a function of temperature. Examples of calculations are given for the case of sodium. (B.J.H.)

6354

ANALYSIS OF THE PHENOMENON OF PRODUCTION OF MONOENERGETIC POSITRONS. L. A. Sliv. J. phys. radium **16**, 589-93(1955) July. (In French)

Formulas for the coefficients of conversion with the formation of positrons with single energy have been obtained for different kinds of radiations and their analysis has been carried out. The question has been examined of the possibility of using the formation of positrons with single energy to determine the width of nuclear levels with energies of excitation of 1 to 6 Mev. (auth)

6355

ON THE PAIRS FROM MONOPOLE TRANSITION OF O^{16} . S. Gorodetzky, R. Armbruster, and P. Chevallier. J. phys. radium **16**, 594(1955) July. (In French)

The angular correlation of the monopole transition electron pairs from the first excited level 0^{+} of O^{16} is studied experimentally. The luminosity of the apparatus employed enables the study of this angular correlation in different energy regions of the electrons. (auth)

6356

ELECTRON ENERGY LOSSES IN METALLIC FILMS OF SILVER AND GOLD. Bernard Gauthé. Compt. rend. **241**, 188-90(1955) July 11. (In French)

Results of energy losses in gold and silver foils are tabulated for 30-kev electrons. Modifications of the electrostatic spectrograph used are described in detail. (B.J.H.)

6367

COMPARATIVE TRANSMISSION OF NEGATRONS AND POSITRONS BY THIN METALLIC SHEETS, STUDIED BY MEANS OF NUCLEAR EMULSIONS. Georges Marguin and Monique Maitrot. Compt. rend. **241**, 192-5(1955) July 11. (In French)

The application of the nuclear emulsion technique to the study of electron absorption in platinum and aluminum foils permits measurement of the differences of the limit of absorption and coefficient of transmission for elements of high atomic number for energies from 100 to 150 kev. (tr-auth)

6368

STUDY OF THE EMISSION OF ELECTRONS ACCOMPANYING β^{-} RADIATION BY THE METHOD OF $\beta^{-}e^{-}$ COINCIDENCES. Maurice Duquesne. Compt. rend. **241**, 195-7(1955) July 11. (In French)

A study of the origin of $\beta^{-}e^{-}$ coincidences in β^{-} disintegrations has led to separation of different effects, such as backscattering and $\beta^{-}e^{-}$ scattering in the source material and its holder. After removing these parasitic phenomena, the study of the residual electronic component was undertaken by the method of $\beta^{-}e^{-}$ coincidences. (tr-auth)

GASES

6369 AD-27621

Ohio State Univ., Columbus. Cryogenic Lab. GASEOUS DATA OF STATE. II. THE PRESSURE-VOLUME-TEMPERATURE RELATIONSHIPS OF GASEOUS NORMAL HYDROGEN FROM THE CRITICAL TEMPERATURE AND UP TO 200 ATMOSPHERES PRESSURE. Technical Report No. 25 on LIQUID HYDROGEN AS AN AIRCRAFT FUEL. Herrick L. Johnston, David White, Henry Wirth, Carroll Swanson, Lyle H. Jensen, and Abraham S. Friedman—Marjorie R. Lassettre, ed. Nov. 25, 1953. 20p. (TR-264-25)

The pressure-volume-temperature relationships of gaseous normal hydrogen were determined at close intervals of temperature and pressure, from the critical point to 300°K. The experimental results are represented by 20 isotherms. From these data, the Boyle temperature was determined to be $104 \pm 0.5^{\circ}\text{K}$. From the experimental data of state of gaseous hydrogen, computations of the virial coefficients were made, using the virial equation of state of Kamer-Hugh-Onnes. (auth)

6370 NP-5719

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics. THE OPTICAL PROPERTIES OF ATOMIC VAPORS NEAR RESONANCE. Technical Report No. 292. Francis Bitter. Mar. 16, 1955. 20p. DA Project No. 3-99-12-022. Contract DA36-039-sc-42607.

This paper summarizes and amplifies well-known results in order to facilitate the design of magnetic scanning experiments and to lay the ground for a further analysis of double-resonance phenomena produced by simultaneous r-f and optical resonance. The reflection, refraction, and attenuation of light incident on the plane face of a cell containing an atomic vapor are calculated for frequencies in the vicinity of an absorption frequency. The significance of the results obtained is discussed and a few numerical examples are considered. It is found that observation of the attenuation of a transmitted beam offers certain advantages over observation of scattered light in scanning experiments. (auth)

6371

ON THE CALCULATION OF THE SURFACE AREA OF ADSORBENTS FROM THE ADSORPTION ISOTHERMS. A. G. Parts (C.S.I.R.O., Chatswood, Australia). Australian J. Appl. Sci. **6**, 183-9(1955) June.

Expressions which have been derived for the slopes of ϕA vs $\phi \Sigma$ from Langmuir's monolayer, Hüttig's two layer, and the B.E.T. multilayer adsorption isotherm equations are shown to be similar to those used by Gregg in the discussion of the calculation of the surface area of adsorbents. It is shown that the Y-point procedure of Gregg cannot be considered as an independent method for surface area calculation, and that the slope at the Y-point will yield monolayer coverages different from those at the Y-point itself. (C.W.H.)

INSTRUMENTS

6372 AECU-3059

David Sarnoff Research Center, Princeton, N. J.
ELECTRONIC DEVICES FOR NUCLEAR PHYSICS.
QUARTERLY REPORT NO. 19 [FOR] FEBRUARY 1, 1955-
APRIL 30, 1955. R. H. Anderson, M. H. Greenblatt, and
A. H. Sommer. (This report also covers work on
photoelectric emission which is not included in the con-
tract, and was done by: A. L. Solomon and A. H. Sommer).
18p. [For Oak Ridge National Lab.] Contract W-7405-
eng-26, Subcontract 308.

Preliminary experiments were done on the possible re-
lationship between photoelectric sensitivity and crystal
structure of multi-alkali photocathodes. Cathodes of
Sb-K-Li and Sb-Rb-K were shown to have cutoffs at
shorter wave lengths than standard cathodes. The effect of
Rb and K on secondary emission in special experimental
tubes was also studied. Designs have been made for a high
speed photomultiplier embodying a central potential. The
testing and characteristics of another high-speed mul-
tiplier tube H 6791-1, are discussed fully. Methods of
photoelectron collection are discussed. A modified 9-in.
cathode photomultiplier tube is shown. (For preceding
period see AECU-3006.) (B.J.H.)

6373 AWRE-O-13/55

Gt. Brit. Atomic Weapons Research Establishment,
Aldermaston, Berks, England.
CALIBRATION OF ARCTON LEAK DETECTOR. F. P.
Evans. May 3, 1955. 13p.

A B.T.H. Arcton Leak Detector was calibrated by
observing the output current of its control unit as various
concentrations of arcton in the air were applied to the
probe. Observations were made in the concentration range
of 0 to 3 parts per thousand of the halogen compound vapor
in the air. It was concluded that calibration changes with
continued use. (B.J.H.)

6374 AWRE-O-19/55

Gt. Brit. Atomic Weapons Research Establishment,
Aldermaston, Berks, England.
A PRE-AMPLIFIER FOR USE WITH PIEZO-ELECTRIC
GAUGES. A. Stead, S. Melville, and F. A. Key. May 26,
1955. 17p.

Details are given of a pre-amplifier designed for use
with piezoelectric crystal gages for recording air blast
pressure transients. (auth)

6375 BRL-Memo-890

Ballistic Research Labs., Aberdeen Proving Ground, Md.
MAGNETIC MATERIALS USED IN DIGITAL COMPUTER
MAGNETIC CIRCUITS. LeRoy F. Silva. Apr. 1955.
54p. DA Project No. 5B0306002.

This report is a survey and compilation of theories and
data dealing with magnetic materials used in digital
computer magnetic circuits. A set of performance
criteria is presented to aid in the selection of materials for
computer applications. A theory is presented which
describes the mechanism of switching in a magnetic m
material subjected to an applied pulse field. Data in support
of this theory is given. Correlations are made between the
theory and performance criteria. A comparison of
metallic materials and ferrites is made for computer ap-
plications. Characteristics and chemical compositions of
available materials, along with suggestions as to which
materials are best suited for particular applications are

given. The appendices contain a modern theory of the
hysteresis loop along with experimental supporting
evidence and a description of an experimental apparatus for
magnetic core testing. (auth)

6376 CERN-PS/PD-4

[European Organization for Nuclear Research, Geneva].
APPAREIL RÉCEPTEUR DE RÉSONANCE NUCLÉAIRE
POUR STABILISATION DE CHAMPS MAGNÉTIQUES.
(Nuclear Resonance Receiver for Stabilization Magnetic
Fields). P. Denis. June 1955. 3p.

The use of transistors in a nuclear resonance receiver
apparatus for the stabilization of magnetic fields is
described and the circuit for such a receiver is given.
(B.J.H.)

6377 LA-1906

Los Alamos Scientific Lab., N. Mex.
SERIES DISC GENERATOR. R. S. Dike, F. R. Scott,
D. H. Lawrence, and A. E. Schofield—Vernal Josephson,
ed. Apr. 4, 1955. 32p. Contract W-7405-eng-36.

A scale model series disc generator has been built and
tested as an approach to the solution of the problem of
producing a large quantity of pulsed power and transferring
it to a low impedance load. When pulsed at speeds of
~8000 rpm, the unit produced peak currents of 52,000 amp
in 0.42 sec. The internal impedance is 27 μ ohms and the
energy transfer efficiency at this speed is 1.7%. Detailed
information concerning theory of operation, initial design,
construction, and operating characteristics and problems
is given along with recommendations as to possible applica-
tions and improvements in design to make its use more
practical. (auth)

6378 UCRL-2925

California. Univ., Berkeley. Radiation Lab.
THE BEVATRON RF MEASUREMENT SYSTEM. William
M. Brobeck and Warren C. Struven. Mar. 15, 1955. 22p.
Contract W-7405-eng-48.

The University of California Bevatron r-f measurement
system provides a means of measuring a varying frequency
at 32 predetermined points during a nominal frequency
variation of from 350 kc to 2,500 kc, and displays de-
partures from the calculated frequency to 0.1%. The dis-
play is of the bar-graph type and can be calibrated in terms
of the radial position of the beam circulating in the vacuum
tank so that the position of the beam at each measurement
point can be determined. The r-f measurement system
uses digital techniques throughout and is completely
automatic in operation. (auth)

6379 UCRL-2927

California. Univ., Berkeley. Radiation Lab.
PULSE-TIMING EQUIPMENT FOR THE BEVATRON
MAGNET. Warren C. Struven. Mar. 22, 1955. 17p.
Contract W-7405-eng-48.

The University of California Bevatron magnet-pulsing
equipment provides a means of adjusting the pulse-repeti-
tion rate and the pulse length of current flowing in the
magnet. The unit also provides synchronizing pulses for
the linear accelerator injector as well as various trigger
pulses before, during, and after the flow of magnet current.
The unit derives its timing from a master oscillator operat-
ing at 2 pps. Pulses from the master oscillator are scaled
down to produce the selectable repetition rates for the
magnet current. Other timing functions, except the magnet
pulse length, are derived from standard time-delay circuits.

Magnet pulse length is generated by a new type of Schmitt trigger circuit, which maintains a long-term time stability of better than 1 part in 2,000. (auth)

6380 TT-526

ON THE RANDOM LIGHT IN OPTICAL INSTRUMENTS. (Über Das Falschlicht in Optischen Instrumenten). J. Hartmann. Translated by D. A. Sinclair from Optik **11**, 351-65(1954). 22p.

A general review of random light is first given. The true brightness of photographic objectives is also discussed, and the amount of random light in optical instruments is determined. (B.J.H.)

6381

AMPLITUDE ANALYZER OF IMPULSES WITH ELECTRON-BEAM TUBE. B. G. Khartman, I. N. Leont'eva, A. P. Sinyavokii, and L. V. Vasil'ev. Zhur. Eksptl'. i Teoret. Fiz. **28**, 699-705(1955) June. (In Russian)

6382

A SPECTROMETER FOR SINGLE CRYSTAL NEUTRON DIFFRACTION. G. E. Bacon and R. F. Dyer (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. **32**, 256-7(1955) July.

A description is given of an instrument for neutron crystallography, specially designed for measurements with single crystals. The small size is in marked contrast with that of conventional spectrometers designed for powder diffraction methods. (auth)

6383

POSITIVE ION OSCILLOSCOPE TRIGGER FOR SHOCKS IN LOW-DENSITY GASES. Douglas Venable (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. **26**, 729(1955) July.

An oscilloscope trigger signal has been obtained from the interruption of a positive ion beam by a shock wave in gas, extending shock detection to regions below 5 mm Hg. The physical arrangement of the apparatus and the circuitry are shown in detail. (B.J.H.)

ISOTOPES

6384

ISOTOPIC MASSES. III. $A > 201$. J. R. Huizenga. Physica **21**, 210-24(1955) May. (In English)

The masses and binding energies of nuclides with mass number greater than 201 are computed from mass spectroscopic data in combination with nuclear disintegration energies.

6385

ISOTOPIC MASSES. I. $A < 34$. A. H. Wapstra (Inst. voor Kernfysisch Onderzoek, Amsterdam, Netherlands). Physica **21**, 367-84(1955) May. (In English)

The binding energies and atomic masses are computed for all known nuclei with mass number < 34 from nuclear reaction energies. Fair agreement with the most modern mass spectroscopic measurements is obtained by applying a slight change in the energy calibration for nuclear reaction measurements. (auth)

6386

ISOTOPIC MASSES. II. $33 < A < 202$. A. H. Wapstra (Inst. voor Kernfysisch Onderzoek, Amsterdam, Netherlands). Physica **21**, 385-409(1955) May. (In English)

The masses and binding energies of nuclides with mass

number between 33 and 202 are computed from mass spectroscopic data in combination with nuclear reaction energies. (auth)

6387

ISOTOPE SHIFTS IN THE SPECTRUM OF HELIUM. A. P. Stone (Clarendon Lab., Oxford, England). Nature **176**, 130 (1955) July 16.

The specific shifts of the 2^1S and 2^3S terms of helium were calculated in first-order perturbation theory and compared to experimental values. It was concluded that nuclear motion makes the most important contribution to the isotopic shift. (B.J.H.)

6388

PREPARATION AND APPLICATION OF ISOTOPES. L. Groven. Bull. sci. A.I.M. (Belg.), No. 5, 411-15(1955) May. (In French)

A brief general discussion is given on several methods of preparation of isotopes and on some of the more common applications of radioisotopes. (B.J.H.)

6389

STABLE AND RADIOACTIVE ISOTOPES IN SCIENTIFIC INVESTIGATION. Hellmuth Freimuth. Comuns. inst. nacl. invest. cienc. nat. museo argentino cienc. nat. "Bernardino Rivadavia," Ser: Publs. extension cultural y didactica, No. 9, 1-87(1954). (In Spanish)

A general discussion is given on the properties of radioisotopes, stable isotope separation, information on isotopes available for scientific use, the various uses of isotopes, and radiation shielding. (B.J.H.)

ISOTOPE SEPARATION

6390 ORNL-1902

Oak Ridge National Lab., Tenn.
CHEMISTRY IN THE ELECTROMAGNETIC SEPARATION OF TANTALUM ISOTOPES. Boyd Weaver, R. L. Bailey, and C. W. Sheridan. May 23, 1955. 12p. Contract W-7405-eng-26.

The chemistry of Ta is reviewed as it has been applied to the preparation of suitable charge material for the electromagnetic separation of its natural isotopes and the chemical refinement of Ta^{180} . (auth)

6391 AEC-tr-2195

ENRICHMENT OF 6Li THROUGH ELECTROLYTIC CONVERSION IN MELTED $LiCl$. Alfred Klemm. Translated by Yessie Garrett from Z. Naturforsch. **6a**, 512(1951). 1p.
By sending a 0.5 amp. direct current between two graphite cathodes in melted $LiCl$, enrichment of Li^6 took place in the cathode area. A separation factor of 2.4 was attained. (B.J.H.)

6392

THERMAL DIFFUSION COLUMN FOR CONCENTRATING TRITIUM IN TRITIUM-HYDROGEN MIXTURES. E. Almqvist, K. W. Allen, and J. H. Sanders (Atomic Energy of Canada Ltd., Chalk River, Ontario). Rev. Sci. Instr. **26**, 649-54(1955) July.

A hot wire thermal diffusion column of the type described by Clusius and Dickel has been constructed to increase the concentration of tritium in tritium-hydrogen mixtures. The column, 350 cm long and 2.86 cm in diameter, produced an equilibrium separation factor of 680 when filled to a pres-

sure of 64 cm of mercury with hydrogen containing 3.5% tritium. (auth)

6393

CONCENTRATION OF ISOTOPES BY VERY RAPID ELECTROMIGRATION ON PAPER. Andre Bonnin, Marius Chemla, and Pierre Sue. Compt. rend. **241**, 40-2(1955) July 4. (In French)

A method of electromigration on paper using high electric fields has been developed. It permits covering large distances in a short time. Applied to the separation of the isotopes Na^{22} and Na^{24} , it gives ratios $\text{Na}^{22}/\text{Na}^{24}$ varying from 0.28 to 1.83 from one extremity to the other of the radioactive spot. (tr-auth)

6394

ISOTOPE SEPARATION BY IONIC EXPANSION IN A MAGNETIC FIELD. Joseph Slepian (Westinghouse Research Labs., East Pittsburgh, Penna.). Proc. Natl. Acad. Sci. U. S. A. **41**, 451-7(1955) July.

A theoretical discussion is given on the amount of isotope separation that could be expected, under certain conditions, for a gas consisting of two isotopic ions, by ionic expansion in a magnetic field. (B.J.H.)

MASS SPECTROGRAPHY

6395

RECENT RESEARCH WITH AN EXPERIMENTAL MASS SPECTROMETER. G. P. Barnard (National Physical Lab., Teddington, England). J. Electronics (1) **1**, 78-102(1955) July.

The special features of an experimental mass spectrometer constructed at the National Physical Laboratory are described. The mass spectrometer (an all-metal instrument) was designated as a precision engineering job for easy dismantling and reassembly. The design was for a 60° sector type, first-order, single focusing, with a 4 in. radius of curvature in the magnetic analyzer. Precise angular and linear adjustments of the spectrometer with respect to the magnet could be made during full operation. Measurements were made of the fringing field distribution. The application of ideal field theory to correct for the integrated effect of the fringing flux is, in general, supported by the experimental results obtained with this instrument. This instrument was used mainly for studies of the behaviour of ion sources of the electron bombardment type. Experiments were undertaken with a trochoidal electron beam system. Facilities were available to vary the source details, such as slit widths and electrode spacings, and the relative potentials applied to the different electrodes. The magnetic field in the source region was varied also. In this way, extensive investigations were made of 'voltage effects' for various source arrangements. The competing influences of (1) ion beam spread in the plane of the final source slit controlling the transmission efficiency of this slit, and (2) the semi-angle of divergence, α , of the transmitted beam controlling the spherical aberration in refocusing, are clearly exhibited. With a small source magnetic field, a high ionic transmission and a small α cannot be obtained simultaneously with identical potential arrangements in the source. This may be due to lateral velocity components acquired by ions formed in electron beams. The paper concludes with a study of the dependence of mass resolution on the magnitude of the source magnetic field, and a discus-

sion of scanning arrangements necessary to secure the optimum performance in sector-field instruments. (auth)

6396

APPLICATIONS OF THE OPTICS OF ELECTRIC CHARGES TO MASS SPECTROMETRY. M. R. Vauthier. J. phys. radium **16**, 64s-5s(1955) July. (In French)

The general features of a new mass spectrometer are discussed with special attention being paid to a lens which will correct for aberration and to the ion trajectories. (B.J.H.)

MATHEMATICS

6397 ORNL-1919

Oak Ridge National Lab., Tenn.

SOME CONTRIBUTIONS TO FACTOR ANALYSIS.

William Gerow Howe. Aug. 4, 1955. 127p. Contract W-7405-eng-26.

The subject of factor analysis is discussed fully including a review of the subject, models used in such an analysis, computational methods used in the general case, the model with orthogonal factors, the model with oblique factors, and prediction and testing of the model. (B.J.H.)

6398 R-264(RAND)

RAND Corp., Santa Monica, Calif.

APPROXIMATIONS FOR DIGITAL COMPUTERS. Cecil Hastings, Jr. Nov. 1954. 207p.

The best approximations in the sense of Chebyshev as applied to the problem of making univariate function data available to the high-speed digital computers are tabulated. (C.W.H.)

6399 TPI-75

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

ALGEBRAIC TABLES OF CLEBSCH-GORDAN COEFFICIENTS. B. J. Sears and M. G. Radtke. Aug. 1954. 11p.

Algebraic formulas for the Clebsch-Gordan coefficient $(j_1 j_2 m_1 m_2 | j m)$ for $j_1 = \frac{1}{2}, 1, \frac{3}{2}, 2, \frac{5}{2}$, and 3 are tabulated. (C.W.H.)

MEASURING INSTRUMENTS AND TECHNIQUES

6400 BNL-344

Brookhaven National Lab., Upton, N. Y.

AREA SURVEY MANUAL. AREA RADIATION DETECTION, INSTRUMENTATION, MAINTENANCE, AND RESULTS.

Max M. Weiss. Jan. 1, 1952. Revised June 15, 1955. 152p.

This is a revision of BNL-167.

A series of 16 automatically operated radiation monitoring stations was set up at distances up to 10 miles from the center of the Brookhaven National Laboratory site. Instruments were installed to measure α , β and γ activities, and to differentiate between airborne activity and activity arising from the soil or subsurface water. Each instrument panel is photographed automatically ten times an hour to provide a permanent record of monitoring data. Instruments designed for use in these monitoring stations are described in detail. Photographs of the instruments and components and circuit diagrams are included. Installation, calibration, operating, and servicing procedures are described. Analyses of data on natural background radia-

tion and on area radiation measurements as affected by pile operations and atomic explosions are included. (C.H.)

6401 BNL-351

Brookhaven National Lab., Upton, N. Y.
NEUTRON MONITORING WITH INDIUM FOILS. F. B. Oleson. July 1955. 15p.

A study has been made of the use of indium foils in a paraffin moderator for a rough determination of neutron spectra. The maximum of a plot of corrected foil activity times the square of distance from the neutron source against depth in the moderator occurs at depths varying from 0.3 in. for 30 kv neutrons to 4.5 in. for 15 Mev neutrons. Sensitivity adequate for health physics applications of the method is obtained by use of 2 in. diameter foils and a flow type counter. Paraffin discs 7 in. in diameter were found to be satisfactory. However, cadmium and boraffin shields around the series of discs are sometimes desirable to eliminate scattered radiation. (auth)

6402 LE-36

Atomic Energy of Canada Ltd. Chalk River Project,
Chalk River, Ont.

THE DETERMINATION OF RADON CONCENTRATIONS
IN AIR. G. Cowper and S. D. Simpson. [1953?]. 9p.
(AECL-78)

Equipment for the determination of Rn concentration in air is described and illustrated. The air sample is admitted to a chamber in which is placed a thin foil held at negative potential, and behind this foil is a zinc sulfide screen and an end-window photomultiplier. The Rn decay products, which by recoiling are left positively charged, are attracted to the foil, and subsequent α particles may be detected by the phosphor. (C.H.)

6403 NARF-55-44T

Consolidated Vultee Aircraft Corp., Fort Worth, Tex.
MINIATURE PULSE INTEGRATOR. PRELIMINARY REPORT. R. R. Hayes and A. R. Robinson. June 30, 1955. 12p. Contract AF33(038)-21117, Task III. (MR-N-94)

A miniature pulse integrator, suitable for use under airborne conditions, which will amplify a detector spectrum, sort, count, and weight pulses, and then give information on the area under the integral bias curve, is discussed. Complete block diagrams and circuitry are given. (B.J.H.)

6404 NP-5720

Dugway Proving Ground, Tooele, Utah.
SURFACE RADIATION MONITOR. Developmental Report No. 2. Richard O. Salisbury, Don B. Clark, and William B. Tench. Dec. 24, 1953. 17p.

Design features are described for a surface radiation monitor developed to monitor clothing exposed to radioactive dust and particles, and to indicate when either of two levels of radiation were exceeded. Photographs of the instrument and circuit diagrams are included. (C.H.)

6405 NRL-4566

Naval Research Lab., Washington, D. C.
EXPERIMENTAL GAMMA RADIAC CALIBRATOR. Interim Report. J. D. Graves. June 6, 1955. 17p.

A semiportable gamma radiac calibrator has been constructed for use with portable survey radiac instruments. The calibrator is completely self-contained and requires no further installation of shielding, electricity, or facilities; it is believed to be capable of calibration accuracies to within four percent of a standard. (auth)

6406 USNRDL-TR-35

Naval Radiological Defense Lab., San Francisco.
MEASUREMENT OF INTENSE BEAMS OF THERMAL RADIATION. A. Broide and A. B. Willoughby. Feb. 1, 1955. 40p. Project No. NS-081-001. (AFSWP-797)

Thermal radiation calorimeters have been constructed with relatively thick receivers which permit the direct recording of integrated thermal energy dose as a function of time. However, it is shown that the rate of change of recorded temperature can be made proportional to the rate of delivery of energy within a reasonably short time constant. Thus, differentiation of the recorded temperature data will give an accurate picture of the irradiance-time history of an impinging pulse. Calorimeters have been successfully used, both in the laboratory and in the field, to measure, with a time constant of 20 milliseconds or less, radiant energy pulses up to 100 cal/sq cm with peak irradiances up to 200 cal/sq cm/sec. (auth)

6407

DEPTH DISTRIBUTION OF IONIZATION FROM A BETA-TRON BEAM. David T. Goldman and Henry Brysk (Vanderbilt Univ., Nashville, Tenn.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 74, 323-9(1955)

The ionizing secondary radiation produced by a bremsstrahlung spectrum decays roughly according to a difference of exponentials. The present work has explored the simplifications that can be made for the bremsstrahlung spectrum from a betatron beam. It has been found possible to eliminate a major portion of the calculational labor hitherto associated with this problem, and to evolve a straightforward and reasonably short computational routine without appreciable loss of accuracy. (auth)

6408

ON MASS DETERMINATION BY LOADED NUCLEAR EMULSIONS BY MEANS OF THE METHOD OF VARIABLE CELLS. B. Roederer (Max-Planck-Institut für Physik, Göttingen, Germany). Nuovo cimento (10) 2, 135-48(1955) July. (In German)

The method of constant sagitta using the cell-size tables calculated by Fay, Gottstein, and Hain was applied for scattering measurements on 10 identified flat protons and 12 π mesons in the region of short ranges (0 to 5000 μ m). Applying usual noise elimination methods, a systematic deviation from the theoretically expected values of D_0 was observed in the case of protons. Diverse sources for noise or systematic errors were investigated. Distortion was found to be insignificant. The falsifications of the results yielded by: (i) the error in reading the cell length, and (ii) the wrong alignment of the track parallel to the stage movement, although significant, are not sufficient to explain fully the systematic deviation. It is found, however, that the usual way of working out second differences for the double cell size from those measured in the basic cells is not unrestrictedly applicable for the constant sagitta method because adjoining cells are frequently not of equal size. It is suggested that noise elimination on short tracks (up to ~ 5 mm) should either be done between two different cell schemes, i.e., by measuring each particle twice, e.g., once in the $\pi_{0,1}$ scheme and once in the $P_{0,1}$ scheme; or by applying appropriate corrections in the conventional noise-elimination method. The magnitude of these corrections will then depend on the alignment and length of the track, the mass of the particle and the scheme used. By measuring each par-

ticle in two different schemes, we obtain a very good accordance with the values expected by the formula

$$D_0 = 0.5 (M_{\text{scheme}}/M_{\text{particle}})^{0.43}$$

without any correction to the scattering constant assumed by Fay et al. The calculated noise-level is shown to increase rapidly for double and quadrupole cell-size. (auth)
6409

ON THE COUNTING OF GRANULAR GROUPS IN NUCLEAR EMULSIONS. I. Iori and A. Roveri (Univ. Modena, Italy). Nuovo cimento (10) 2, 165-7(1955) July. (In Italian)

6410

THE "HODOSCOPE CHAMBER:" A NEW INSTRUMENT FOR NUCLEAR RESEARCH. M. Conversi and A. Gozzini (Univ. of Pisa, Italy). Nuovo cimento (10) 2, 189-91(1955) July. (In English)

Complete descriptions and block diagrams are given for this new radiation detection instrument. Its design is based on the principle that a strong electric field produced soon after an ionizing particle has passed through a gas-filled space causes a luminous discharge throughout the region. Some ionizing events detected in this manner are also shown. (B.J.H.)

6411

NEUTRON SPECTROSCOPY BY CRYSTALLINE DIFFRACTION. J. M. Auclair, P. Hubert, and G. Vendryes (Commissariat à l'Énergie Atomique, Paris). J. phys. radium 16, 50s-2s(1955) July. (In French)

A neutron spectrometer is described in which monoenergetic neutrons are obtained by placing a crystal in the neutron beam. The spectra from U^{235} , U^{233} , and Pu^{239} are shown. (B.J.H.)

6412

DISASTER MONITORING WITH AMATEUR AND COMMERCIAL PHOTOGRAPHIC FILMS. G. M. Corney and H. M. Cleare (Eastman Kodak Co., Rochester, N. Y.). Nucleonics 13, No. 8, 40-1(1955) Aug.

The use of amateur and commercial photographic film as emergency dosimeters in the event of an atomic disaster is discussed. Film sensitivities to radiation, dose-density curves, and proper development conditions are given. (B.J.H.)

6413

LOW-LEVEL BETA COUNTER FOR ROUTINE RADIO-CHEMICAL MEASUREMENTS. Herbert L. Volchok (Isotopes, Inc., Westwood, N. J.) and J. Laurence Kulp (Lamont Geological Observatory, Palisades, N. Y.). Nucleonics 13, No. 8, 49-50(1955) Aug.

A complete description is given of a β counter which is useful for all but the softest β emitters. Sensitivities for $\pm 10\%$ accuracy go down to 0.5 cpm. (B.J.H.)

6414

CLOUD CHAMBER FOR PRECISION MEASUREMENTS. W. B. Fretter and E. W. Friesen (Univ. of California, Berkeley). Rev. Sci. Instr. 26, 703-10(1955) July.

A cloud chamber has been constructed in which accurate measurements of ionization and momentum can be made simultaneously. The chamber has a useful volume of 18 by 12 by 5 in., contains helium, and is in a magnetic field of 7500 gauss. Procedures have been developed to measure momentum and ionization and to determine the errors. Measurements on 40 protons indicate an average probable

error of 7% for an individual measurement of mass by the comparison of ionization and momentum. A calibration technique is used for the determination of the minimum ionization for each case. (auth)

6415

PULSE-HEIGHT VARIATION IN SCINTILLATION COUNTERS. P. R. Bell and R. C. Davis (Oak Ridge National Lab., Tenn.) and W. Bernstein (Brookhaven National Lab., Upton N. Y.). Rev. Sci. Instr. 26, 726-7(1955) July.

A shift in pulse height of as much as 20% with a counting rate change has been observed in scintillation counters. This effect is a property only of the photomultiplier and seems worst in the 6292, 6363, and 6364 tubes. The pulse height shift is greater for high-energy pulses than it is for low-energy pulses. It has also been observed that the effect is a rapid one. (B.J.H.)

6416

STRENGTH OF PLASTIC WINDOWS AT 20°K. Douglas Parmentier, Jr. (Univ. of California, Berkeley). Rev. Sci. Instr. 26, 728-9(1955) July.

Impact, tensile strength, and fatigue tests were made on samples of Plexiglas at 20°K in order to determine its possible usefulness as a window for a liquid hydrogen bubble chamber. It appears that Plexiglas can be used for this purpose. (B.J.H.)

6417

COINCIDENCE CORRECTIONS FOR GEIGER TUBES USED WITH ALTERNATING CURRENT X-RAY EQUIPMENT. R. E. Barieau (California Research Corp., Richmond). Rev. Sci. Instr. 26, 729-30(1955) July.

Some remarks are made on the validity of the paired source technique for making coincidence corrections for Geiger tubes. (B.J.H.)

6418

EXPERIMENTALLY DETERMINED ELECTRON ENERGY DISTRIBUTION PRODUCED BY COBALT 60 GAMMA RAYS. W. R. Bruce and H. E. Johns (Univ. of Saskatchewan and Saskatoon Cancer Clinic, Canada). Brit. J. Radiol. 28, 443-5(1955) Aug.

Results are reported from organic scintillation spectrometric measurements of the distribution of electron energies in a water phantom at points down the central axis of a collimated Co^{60} γ -ray beam. (C.H.)

6419

THE BUBBLE CHAMBER. C. Dodd (Univ. Coll., London). Nature 176, 142-4(1955) July 23.

A general discussion is given on the principles, construction, and uses of bubble chambers. (B.J.H.)

6420

A SPECTROMETRIC METHOD FOR THE STUDY OF RADON PARTITION IN RADIUM-BURDENED ANIMALS. P. F. Gustafson and L. D. Marinelli (Argonne National Lab., Lemont, Ill. and Univ. of Chicago Medical School). Radiology 65, 90-5(1955) July.

The fraction of radon retained in a radium-burdened animal can be determined experimentally *in vivo* by measuring with scintillation spectrometers the relative intensities of the Ra^{226} and RaB gamma rays emitted by the animal and by comparing them to those obtained with properly de-emanated Ra sources placed in suitable phantoms. The soundness of the technic has been proved by experiment on rabbits and dogs. The possibility of its use in other fields of investigation has been briefly discussed. (auth)

6421

STUDIES WITH RADIOIODINE. IV. COLLIMATING CONES FOR CRYSTAL COUNTERS. Earl R. Miller and Norman E. Schofield (Univ. of California School of Medicine, San Francisco). *Radiology* 65, 96-107(1955) July.

Four multichannel and two single-channel collimators were fabricated and tested for sensitivity and degree of collimation by studying the response of the counter to which they were attached, at various distances from a point source of I^{131} . A scanning device is described for moving the counter and collimator over the point source at the same rate the response of the counter is recorded. The recorder plots a bell-shaped curve for each scan at each distance between the source and counter. The sensitivity of each of the counter-collimator combinations is given by the height of the scan curve. The width of the curve at half its height gives a measure of the degree of collimation provided by the collimator. A figure of merit, a single expression evaluating both sensitivity and degree of collimation, was determined for each collimator at various distances between source and counter (collimator face). It was given by the product of signal-to-noise ratio (height of the scan curve divided by the background) and the measure of collimation (1 over the width of the scan curve at half maximum height). It was found that, when the face of the collimator was less than 7 cm from the source, one of the single-channel collimators in the form of an inverted cone with a 1-cm aperture (called the cone plug collimator) had the highest figure of merit. At all greater distances, a multichannel collimator called the honey cone collimator had the highest figure of merit. (auth)

6422

DIRECT SPECTROPHOTOMETRY OF SPOTS OF CHROMATOGRAPHED COBALT AND COPPER ON PAPER.

Alice Lacourt and Paula Heyndryckx. *Compt. rend.* 241, 54-6(1955) July 4. (In French)

The direct spectrophotometry of chromatographed spots on paper is a method of dosimetry which is rapid and reproducible to at least 0.5% according to Beckman. It takes place at a given wave length and is feasible whatever the position of the spot in the chromatogram. (tr-auth)

6423

SCATTERING OF LIGHT BY COLLOIDAL PARTICLES AND THE DETERMINATION OF THEIR SIZES. Y. G. Naik and D. K. Sohoni (Gujarat Coll., Ahmedabad, India). *Indian J. Phys.* 29, 55-64(1955) Feb.

Two optical methods based on the Mie theory of the scattering of light by spherical particles are used in the present investigation for determining the size of the colloidal particles. One method is based on the comparison of the experimentally observed distribution of the intensity of light scattered by colloidal particles in different directions with the theoretical distribution of the same by particles of different sizes. The other method is based on the comparison of the dissymmetry of scattered light with the theoretical dissymmetry for similar particles. Both the methods are used for determining the sizes of the colloidal particles of Fe_2O_3 and As_2S_3 sols and it is found that the two methods give results, which are in close agreement with each other. (auth)

6424

ANALYSIS OF G-M COUNTER IMPULSES BY THE METHOD OF DELAYED COINCIDENCES. Satya Pal Puri and P. S.

Gill (Muslim Univ., Aligarh, India). *Indian J. Phys.* 29, 95-107(1955) Feb.

An interval analyzer circuit for studying the origin of spurious pulses in G-M counter tubes has been described. The method of delayed count vs delay time has been employed in studying their time distribution. An expression for the probability that a real discharge creates an after discharge has been derived. The present investigations give: (i) An exponential decrease of dead and recovery times with overvoltage, (ii) The life of the petroleum ether filled counter and (iii) The values of coefficient of secondary emission. The coefficient of secondary emission seems to increase exponentially with overvoltage. It is concluded that the alteration of the optimum gas composition by deterioration with use is the main cause responsible for the high values of this coefficient. The possibility of negative ion formation by molecular dissociation is also suspected. (auth)

6425

A FAST-NEUTRON SCINTILLATION COUNTER WITH TISSUE RESPONSE. R. Skjöldebrand (AB Atomenergi, Stockholm, Sweden). *J. Nuclear Energy* 1, 299-305(1955) June.

A scintillation counter for fast neutrons has been constructed. It has a response for different neutron energies that approximately equals the tissue dose-energy function. It is non-directional, gives a fair counting rate even for neutron fluxes below the tolerance levels, and has good gamma discrimination properties. (auth)

MESONS

6426 AEC-tr-2185

NUCLEAR DISINTEGRATIONS ASSOCIATED WITH HEAVY UNSTABLE PARTICLES. I. M. Gramenitskii, E. A. Zamchalova, M. I. Podgoretskii, M. I. Tretyakova, and M. N. Schcherbakov. Translated by V. Rimsky-Korsakoff from *Zhur. Eksptl'. i Teoret. Fiz.* 28, 616-17(1955). 4p.

Results are given of a statistical analysis of over one hundred nuclear disintegrations in photographic emulsions in which hyperons and heavy mesons were formed. Data show that conditions for generation of Y^+ and Λ^0 particles are similar. It is also concluded that K and τ mesons are different particles, and that nuclear capture of K^- mesons occurs with simultaneous formation of Λ^0 particles. (B.J.H.)

6427

ČERENKOV AND ISOTROPIC RADIATIONS FROM SINGLE μ -MESONS IN AIR. F. R. Barclay and J. V. Jelley (Atomic Energy Research Establishment, Harwell, Berks, England). *Nuovo cimento* (10) 2, 27-37(1955) July. (In English)

The Cherenkov effect has been used to detect single μ mesons in 6 m of air at atmospheric pressure. The yield of light and rate of occurrence of events is consistent with the classical theory of the effect. A separate experiment revealed that, in the absence of Cherenkov radiation, the production of light associated with ionization is $<10^{-2}$ of that of Cherenkov radiation, or $<4 \times 10^{-6}$ of the rate of loss of energy by ionization for relativistic μ mesons. (auth)

6428

SOME ASPECTS OF THE NUCLEAR CAPTURE OF HYPERONS AND K-MESONS. M. W. Friedlander, Y. Fujimoto, D. Keefe, and M. G. K. Menon (Univ. of Bristol, England). *Nuovo cimento* (10) 2, 90-9(1955) July. (In English)

Some predictions are made concerning the characteristics of the interactions produced by the nuclear capture of K^- and Y^- particles. It is assumed that the capture reaction is the inverse of the "associated production mechanism." A comparison is made between these predictions and the experimental data. The significant conclusions are: (i) the capture process sometimes involves two or more nucleons rather than a single nucleon; (ii) in view of the possible existence of Σ^0 -particles and their rapid transformation to Λ^0 -particles, the observation of Λ^0 -particles as end products of a capture process does not necessarily indicate that they were produced in the initial reaction; (iii) there appears to be an absence of μ -mesons of ~ 120 Mev; this might indicate the production of a Σ^0 -particle instead of a Λ^0 -particle in the initial reaction or that the capture involves two or more nucleons; (iv) the available observations on capture stars are consistent with the general features of the theory of Gell-Mann and Pais. (auth)

6429

AN ANALYSIS OF THREE τ -MESONS. G. Baroni (Univ. of Rome). Nuovo cimento (10) 2, 169-71(1955) July. (In English)

Three positive τ mesons, decaying in a nuclear emulsion which had been exposed in a balloon flight, are analyzed and all pertinent data tabulated. (B.J.H.)

6430

EXISTENCE OF A K_μ PARTICLE. R. Armenteros, B. Gregory, A. Lagarrigue, L. Leprince-Ringuet, F. Muller, and C. Peyrou (Laboratoire de l'École Polytechnique). J. phys. radium 16, 50s(1955) July. (In French)

Among 38,000 cloud-chamber photographs, 45 have shown the tracks of K particles whose lifetimes were between 10^{-8} and 5×10^{-8} sec. A large percentage of these particles were positive, had a mass of 906 ± 27 mu, disintegrated by $K\mu^+ \rightarrow \mu + \nu$, and had a half life of about 10^{-8} sec. The secondary μ mesons had a range in copper of 75.7 ± 1.7 g/cm². (B.J.H.)

6431

CONTRIBUTION TO THE STUDY OF THE INTERACTION OF HIGH-ENERGY μ MESONS WITH MATTER AND CONNECTED PROBLEMS. R. Maze and D. Kessler (École Normale Supérieure, Paris). J. phys. radium 16, 52s-3s(1955) July. (In French)

A general discussion is given of some of the results of high-energy meson experiments. (B.J.H.)

6432

ON THE ELECTROMAGNETIC INTERACTIONS OF μ MESONS IN COUNTER ARRANGEMENTS. Dan Kessler and Roland Maze (École Normale Supérieure, Paris). Physica 21, 425-40(1955) May. (In French)

A critical study of previous experiments on penetrating showers produced by μ mesons showed the need for an extensive investigation of the contribution of the soft secondary component of μ mesons to the counting rate in penetrating shower counter arrangements. In this paper, various experiments are described with the purpose to investigate the effect of this soft secondary radiation of μ mesons on counters embedded in lead. At small distance from the trajectory of the meson, counters are triggered by electron secondaries, but at distances of more than 0.8-cm Pb the contribution of photons in the 2 to 7 Mev range becomes dominant. The intensity of soft radiation in equilibrium with μ mesons depends slightly on the energy of the primaries, as shown by the well known relative increase of soft showers with

depth underground compared to the flux of penetrating particles. This effect is investigated quantitatively. Conversely, any experimental requirement for soft secondaries modifies the energy spectrum of incident μ mesons. As a consequence, two or more events of this type cannot be considered as independent. This effect is here investigated with regard to penetrating shower counter arrangements at stations between sea level and 65 mwe underground. Experimental results show fair agreement with our calculations. By way of illustration the increase has been calculated of the mean energy of the μ meson spectrum produced by some trivial experimental requirements which comes out surprisingly large in some cases. (auth)

6433

ON THE SUPER SIGMA STAR PRODUCED BY THE CAPTURE OF A K_0 MESON. Tsai-Chu. Compt. rend. 241, 294-6(1955) July 18. (In French)

A six-branch star, containing neither π mesons nor hyperons, has been produced by the capture of a K_0 meson. The mass of the heavy, negative meson, measured by granulation and multiple scattering, is to within 10% the same as that of a τ meson. (tr-auth)

6434

RELATION BETWEEN PROBABILITIES OF THREE TYPES OF NUCLEON-ANTINUCLEON ANNIHILATION. I. Kobzarev and I. Shmushkevich. Doklady Akad. Nauk S.S.S.R. 102, 929-32(1955) June 11. (In Russian)

6435

CROSS SECTION FOR ANNIHILATION OF THE ANTI-PROTON. I. Yu. Kobzarev (Moscow Engineering Physics Inst.). Doklady Akad. Nauk S.S.S.R. 102, 1101-2(1955) June 21. (In Russian)

6436

YIELD OF PROCESSES OF FISSION AND STAR FORMATION IN CAPTURE OF π^- MESONS BY U, Bi, AND W NUCLEI. N. A. Perfilov, O. V. Lozhkin, and V. P. Shamov (Radium Inst., Moscow). Zhur. Eksptl'. i Teoret. Fiz. 28, 655-63(1955) June. (In Russian)

MICROWAVES

6437 NP-5714

Columbia Univ., New York. Columbia Radiation Lab. RESEARCH EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 10 [for] March 1, 1955 through May 31, 1955. P. Dusch. May 31, 1955. 55p. DA Project No. 3-99-10-022. Contract DA-36-039-SC-42519. (CU-10-55-SC-42519-Phys.)

Development of the harmonic generator magnetrons is continued. The dependence of low field CW magnetron operation at K-band on cathode geometry was examined. The directivity of various types of sources and the pumping speed of the MASER under ordinary operating conditions have been measured. Progress has been made on the development of a K-band isolator. With simplifying assumptions as to the nature of the crystal, a theoretical conversion loss curve has been obtained. Impedance measurements have been made from 3.5 to 3.7 mm wavelengths. Microwave measurements have been made on D, InI, CO, and CH₃I. The production of OH radical in the dissociation of H₂O and H₂O₂ and from the flame reaction of the H₂-O₂ mixture was investigated. (C.W.H.)

MOLECULAR PROPERTIES

6438

ON THE ROLE OF THE SPIN-SPIN INTERACTION IN MAGNETIC PROPERTIES OF CERTAIN MOLECULES.

M. J. Wucher. *J. phys. radium* **16**, 68s(1955) July. (In French)

NEUTRONS

6439

THE EFFECTIVE CROSS SECTION OF THE $O^{16}(n,\alpha)C^{13}$ REACTION FOR FAST NEUTRONS. J. Seitz and P. Huber. *Helv. Phys. Acta* **28**, 227-44(1955) May. (In German)

The cross section for the reaction $O^{16}(n,\alpha)C^{13}$ as a function of neutron energy was determined by means of a parallel-plate ionization chamber filled with O_2 . A calibrated Hornyak counter was used as a neutron monitor. The counter was calibrated by comparing its efficiency with that of a hydrogen recoil ionization chamber. The variation of cross section with energy of the oxygen reaction from threshold to $E_n = 4.2$ Mev can be ascribed essentially to the change in penetrability of the Coulomb barrier by the outgoing α particles. For $E_n = 4.2$ Mev the cross section reaches a value of $\sigma_\alpha = 130$ mb. Resonances are observed at $E_n = 3.90$ Mev and $E_n = 4.05$ Mev. These resonances correspond to excited states of the intermediate nucleus O^{17} at excitation energies of 7.81 and 7.95 Mev, respectively, above the ground state. The loss of neutrons caused by the oxygen reaction in Ra-Be neutron source strength determinations when water is used as a neutron moderator is discussed. (auth)

6440

A THEORETICAL INVESTIGATION OF NUCLEAR REACTIONS WITH NEUTRONS. M. Cini and S. Fubini (Univ. of Turin, Italy). *Nuovo cimento* (10) **2**, 75-89(1955) July. (In English)

A theory of the interaction of neutrons with complex nuclei is developed with the aim of obtaining a cross section averaged over the resonances, to be compared with the results of the phenomenological model proposed by Feshbach, Porter, and Weisskopf. It is shown what kind of assumptions have to be introduced in order that the compound nucleus formation give rise to an absorption of the incident beam, irrespective of what happens after the compound nucleus decay. The problem is reduced to the determination of the complex index of refraction of an indefinite nuclear matter, taking properly into account the effect of the Pauli principle. Subsequently this index of refraction has to be introduced into a one-body Schrödinger equation with the correct boundary conditions at the nuclear wall. By assuming nuclear forces which fit the low energy two-body data, and an average binding energy of 8 Mev per nucleon, an expression is derived for the absorption coefficient which is compared with the imaginary part of the FPW potential. At zero energy the absorption coefficient is just in the right range 0.03-0.05. For higher energies it becomes so large that already for 6-8 Mev the absorption is almost complete for medium sized nuclei. This agrees quite satisfactorily with experimental evidence. (auth)

6441

NEUTRON DIFFRACTION. G. E. Bacon. London, Oxford Univ. Press, 1955. 299p.

This book gives a comprehensive account of the principles, practice, and achievements of neutron diffraction. The first part of the book deals mainly with physical principles and techniques of measurement including such subjects as elementary concepts of the neutron, the scattering of neutrons by atoms, diffraction of neutrons by crystals, techniques for diffraction measurements, and the principles of magnetic diffraction. The remainder of the book considers the applications for which diffraction has been used. Some of the topics discussed are the determination of atomic positions of the light elements, structural investigations involving distinction between atoms of neighboring atomic number, investigation of magnetic materials such as metals, alloys, oxides, sulfides, and fluorides, neutron polarization and double refraction in magnetic materials, and small angle scattering of neutrons. (B.J.H.)

6442

AN ANALYSIS OF THE NEUTRONS FROM ${}^7Li(dn){}^8Be$ AT 880 KEV. W. M. Gibson (Queen's Univ. of Belfast) and D. J. Prowse (H. H. Wills Physical Lab.). *Phil. Mag.* (7) **46**, 807-9(1955) July.

The photographic plate method was used to obtain the energy spectrum of neutrons emitted at 120° by a 100-kev-thick lithium target bombarded with 930-kev deuterons. Neutron groups are visible at excitation energies of Be^8 of 0, 2.1, 2.1, 2.9, 4.05, and 5.25 Mev. Results are compared to previous results. (B.J.H.)

6443

A METHOD FOR RAPID ANALYSIS OF NEUTRON RESONANCES. D. J. Hughes (Brookhaven National Lab., Upton, N. Y.). *J. Nuclear Energy* **1**, 237-43(1955) June.

Curves are given from which neutron resonance parameters can be obtained directly from measured areas of transmission dips. The principles of this method are discussed and examples are given. (B.J.H.)

NUCLEAR PHYSICS

6444 NP-5722

Naval Research Lab., Washington, D. C. NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period April-June 1955. July 1, 1955. 60p.

The experimental techniques of and spectra from Coulomb excitation, produced by proton or α bombardment, of Te^{123} , Te^{125} , Ag^{107} , and Ag^{109} are given. A search was made for gamma-emitting levels in F^{19} between excitation energies of 8.3 and 9.8 Mev by bombarding a NiO sample with protons. Resonances were observed at proton energies of 630, 849, 1169, 1399, 1685, 1769 and 1931 kev. An extensive discussion is given on the nonmesonic decay of a helium hyperfragment. Notice is given of the publication of a bibliography of photonuclear reactions. Compromise values of the parameters of the nuclear complex square-well model were chosen to fit previously obtained data on the differential elastic scattering of 14 Mev neutrons in Bi, Ta, In, Fe, and S. As an initial step in a program for the use of sulfides as crystal counters, the properties of zinc sulfide were studied. Descriptions of secondary standard metallic Co^{60} sources in the millicurie range are described. The instrumentation, experimental technique, and results of experiments on the double Compton effect are given. Monte Carlo calculations of the slowing of

neutrons in a reactor core assuming a fission spectrum source are made. Work continues on the logarithm power level amplifier reactor control. Several radiation detectors such as an electronic plateau plotter and boron tri-methyl neutron counters were constructed. Results of reactor heat-transfer studies are given. Preliminary results on the preparation of NH_3 from irradiated N-H solutions are given. The effect of Co^{60} radiation on a ferrous hydroxide solution is shown. (For previous period see NP-5617.) (B.J.H.)

6445

EXTRANUCLEAR EFFECTS ON ANGULAR CORRELATIONS OF NUCLEAR RADIATIONS. Rolf M. Steffen (Purdue Univ., Lafayette, Ind.). *Advances Phys.* **4**, 293-362(1955) July.

A comprehensive discussion is given on the extranuclear effects on angular correlations of nuclear radiations, including reviews on the theory and experimental work on this phenomenon. The theoretical discussion includes subjects such as unperturbed angular correlation of nuclear radiation, interaction of nuclear moments with external fields, and the theory of influence of extranuclear fields on the angular correlation. The experimental work discussed includes angular correlation of the Cd^{111} gamma rays, gamma-gamma correlation of the $\text{Pb}^{204\text{m}}$ isomer, angular correlation of the Ta^{181} γ rays, influence of extranuclear effects on α - γ correlations, and γ - γ correlations with no observable influence of extranuclear fields. A comprehensive bibliography is also given. (B.J.H.)

6446

ELEMENTARY THEORY OF NUCLEAR SHELL STRUCTURE. Maria Goeppert Mayer and J. Hans D. Jensen. New York, John Wiley and Sons, Inc., 1955. 269p.

In this book much of the work done on the shell model of the nucleus is brought together. Particular attention is given to the characteristics of stable nuclei, the empirical evidence for the magic numbers, a review of the electronic structure of atoms, the individual orbits in the nucleus, the properties of nuclear ground states, discussion of the empirical data for odd-A nuclei, the determination of parity and occupation numbers by the angular distribution of (d,p) and (d,n) reactions, quadrupole moments and isotope shifts, β decay, especially for odd A nuclei, characteristics of light nuclei, the nuclei of even A, some general facts on nuclear spectroscopy, isomerism in odd A nuclei, and some of the mathematical considerations made. (B.J.H.)

6447

ON THE COLLECTIVE MOTIONS OF ROTATION OF NUCLEI. I. Roger Nataf. *Compt. rend.* **240**, 2510-12(1955) June 27. (In French)

A. Bohr and B. R. Mottelson have predicted the rotation levels in treating the nucleus as a liquid drop. This hydrodynamic model does not exclude the shell model. In order to deduce the composite Hamiltonian for such a system of nucleons, A. Bohr has proposed a transformation of coordinates. It has been found that this does not lead to the sought for results. (tr-auth)

NUCLEAR PROPERTIES

6448

A PHASE SHIFT ANALYSIS OF SCATTERING AND POLARIZATION IN HIGH-ENERGY NEUTRON-PROTON COLLISIONS. C. A. Klein (Laboratoire de Physique de l'École

Normale Supérieure, Paris). *Nuovo cimento* (10) **2**, 38-49 (1955) July. (In French)

The phase shift analysis of scattering and polarization in high-energy neutron-proton collisions can be done according to the principle of the independence of nuclear forces with relation to the charge, if one attributes to the antisymmetric states precisely the phase shifts 1K_0 , δ_0 , δ_1 , and δ_2 , which had already been given attention in the analysis of proton-proton reactions (inversion of the 3P_J levels, repulsive potential 1S). With the aid of three supplementary parameters 3K_0 , 1K_1 , and 3K_2 , one is then in a position for obtaining effective cross sections with remarkable precision and for suitably approaching polarizations. The values are raised by the phase shifts, in particular by 1K_1 , emphasizing the present interest in the potential $V + \lambda V_1^{(A)}$ provided with a repulsive core in the singlet states. The eventual presence of spin orbit type forces can always pose a delicate problem. (tr-auth)

6449

REMARKS ON PION NUCLEAR SCATTERING. U. Haber-Schaim and W. Thirring (Univ. of Bern, Switzerland). *Nuovo cimento* (10) **2**, 100-19(1955) July. (In English)

The scattering of pions on nucleons is considered under the assumption of pv-coupling with cut-off. A model of T. D. Lee is extended in two directions: a) to include recoil effects and b) to admit two mesons in the meson cloud of the nucleon. The model permits a rigorous renormalization prescription without the use of perturbation theory. The phase shifts for the ${}^{1/2} {}^{1/2}$ and ${}^{3/2} {}^{3/2}$ scattering can be calculated to any desired accuracy, in this paper about 10%. (auth)

6450

CROSS SECTIONS NEAR THRESHOLD FOR CHARGED PHOTO-PIONS FROM DEUTERIUM. D. Carlson-Lee, G. Stoppini, and L. Tau (Univ. of Rome). *Nuovo cimento* (10) **2**, 162-4(1955) July. (In English)

Stripped emulsions were used to determine the differential cross sections of the $\gamma + D \rightarrow (n,n) + \pi^+$ and $\gamma + D \rightarrow (p,p) + \pi^-$ reactions. Results are tabulated for various energies and lab. angles. (B.J.H.)

6451

MASSES OF THE NEW PARTICLES AND THE RANGE-ENERGY RELATION. D. O. Caldwell (Massachusetts Inst. of Tech., Cambridge). *Nuovo cimento* (10) **2**, 183-5(1955) July. (In English)

A review is given on the work done on the use of the range-energy relation to calculate particle masses. The accuracy and limitations of this method are discussed. (B.J.H.)

6452

ON THE SHELL MODEL FOR ATOMIC NUCLEI. K. Bleuler and Ch. Terreaux. *Helv. Phys. Acta* **28**, 245-64(1955) May. (In German)

Within the framework of the shell model the shape of the potential well and the distribution of the nucleons in space are calculated (this leads to the charge-distribution). A good agreement is found with the experimental results from high-energy electron scattering. Some questions of the consistency of the model are treated, and the charge independence of nuclear forces is tested in a new way. Finally a more detailed 2-dimensional representation of the level scheme of shell structure is given. (auth)

6453

GAMMA RAYS FROM INELASTIC SCATTERING OF PRO-

TONS ON NITROGEN (N^{14}). Jacques Thirion and Roland Barloutaud. Compt. rend. **240**, 2136-8(1955) June 1. (In French)

Three resonances are observed in the inelastic scattering of protons on nitrogen (level at 2.3 Mev) for the energies enclosed between 3 and 5 Mev. Measurement of the 2.3-Mev γ energy made "in front and behind" by a scintillation spectrometer shows a Doppler effect due to the motion of the nuclei. This implies a mean life of the excited state shorter than 2×10^{-13} sec. Relations between this result and the mean β life of C^{14} are discussed. (tr-auth)

6454

ANGULAR DISTRIBUTION OF THE NEUTRONS FROM THE $Be^9(d,n)Be^{10}$ REACTION. Jeannine Genin. Compt. rend. **240**, 2514-17(1955) June 27. (In French)

A study is presented of the angular distribution of the neutrons leading to the first five levels of B^{10} in the reaction $Be^9(d,n)Be^{10}$ for $E_d = 0.695$ Mev. Only the angular distribution corresponding to the $E_x = 3.62$ -Mev level plays a part in stripping. (tr-auth)

6455

MEASUREMENT OF THE K/L CAPTURE RATIO OF A^{37} . Michel Langevin and Pierre Radvanyi. Compt. rend. **241**, 33-5(1955) July 4. (In French)

The branching ratio of the L to K capture in A^{37} has been determined with a large-volume xenon-filled proportional counter. The value $\lambda_L/\lambda_K = 0.092 \pm 0.010$ was found, a value close to the theoretical value of 0.082. The mean number of ion pairs created by an L process is 1/10.24 of that by a K process. (tr-auth)

6456

THE INTERNAL CONVERSION ELECTRON SPECTRUM OF ^{241}Am . J. F. Turner (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (7) **46**, 687-700 (1955) July.

Observations of the internal conversion electron spectrum of Am^{241} and of $e^- - e^-$ coincidences, using a pair of magnetic lens spectrometers, afford evidence in support of the level scheme in Np^{237} derived from Asaro's α -particle observations, except that no indication of transitions to the ground state is found. Information on the half lives and multipole orders of certain of the γ transitions in Np^{237} is obtained. (auth)

6457

POLARIZATION IN NUCLEON SCATTERING AT VARIOUS ENERGIES. Richard Wilson (Clarendon Lab., Oxford, England). Phil. Mag. (7) **46**, 769-82(1955) July.

The polarization of nucleons elastically scattered from nuclei is discussed on the optical model. Analytical formulae are used to illustrate the differences between various approximations. A uniform spin-orbit potential is shown to be at variance with experiment, unless the magnitude varies with the nuclear radius, and it is shown that the polarization may change sign at an energy close to that for which the total cross section is a maximum. (auth)

6458

THE DECAY OF ^{51}Ti AND THE NUCLEAR LEVELS IN ^{51}V . M. J. Sterk, R. H. Nussbaum, and A. H. Wapstra (Inst. voor Kernfysisch Onderzoek, Amsterdam, Netherlands). Physica **21**, 441-5(1955) May. (In English)

The decay of 5.8-min Ti^{51} has been investigated by means of β - and γ -scintillation spectrometers combined with coincidence counting. It is found that the main β^- spectrum has

a maximum energy of 2.17 ± 0.04 Mev and that it is in coincidence with the well known 0.325 Mev γ -ray which is also present in the electron capture decay of Cr^{51} . An upper limit of 20% could be set to intensity of a β^- transition between the ground states of Ti^{51} and V^{51} . A 0.935 ± 0.015 Mev γ -ray with an intensity of $6 \pm 2\%$ relative to the 0.325-Mev line is also present in the decay of Ti^{51} . No evidence could be found for a 0.48-Mev level in V^{51} . A level scheme is proposed. (auth)

6459

BETA ENERGETICS AND NUCLEAR SHELL STRUCTURE. S. N. Ghoshal and A. N. Saxena (Inst. of Nuclear Physics, Calcutta, India). Indian J. Phys. **29**, 81-94(1955) Feb.

The occurrence of discontinuities in the binding energies of the last neutron or last proton in nuclei at magic numbers of neutrons or protons causes discontinuities to appear in the β^- -disintegration energies $E_\beta(A, Z)$ of radioactive nuclei. The difference $\epsilon_\beta(A, Z)$ between the observed values of $E_\beta(A, Z)$ and the values calculated from the Fermi-Weizsäcker mass formula for a series of isotopes ($Z = \text{constant}$) have been plotted against the neutron number N in these nuclei. Discontinuities are found to appear at $N = 50, 82$ and 126 . In order to show the nature of variation of the pairing energy term in the β^- -disintegration energy, the observed $E_\beta(A, Z)$ values have been plotted against Z for isobaric sequences for various odd values of A . The pairing energy terms have been derived from the $\epsilon_\beta(A, Z)$ values of these isobaric sequences and the corresponding values of B_A , the slope of the isobaric line without the pairing energy term, have been deduced. The departure of the B_A values from the calculated values are discussed. The effect of shell crossing on these isobaric lines is also discussed. Evidences for the occurrence of discontinuity in the pairing energy term for even A nuclei have been observed. (auth)

6460

CONVERSION COEFFICIENTS OF THE L SHELL. I. M. E. Rose (Oak Ridge National Lab., Tenn.). J. phys. radium **16**, 520-3(1955) July. (In French)

A discussion of the role of internal conversion in nuclear spectroscopy and a brief description of the underlying assumptions and the method of calculation of conversion coefficients are given. Preliminary conclusions based on results so far obtained are presented. (auth)

6461

INTERNAL CONVERSION: COMPARISON OF SOME EXPERIMENTAL AND THEORETICAL RESULTS. J. Teillac (Institut du Radium, Paris). J. phys. radium **16**, 524-30 (1955) July.

The coefficients of internal conversion can be calculated as a function of the energy of transition, of the nature and polarity of γ radiation and of the characteristics of the ejected electron. On the other hand the coefficients of conversion or their relative value in different levels can be measured experimentally. The comparison of the experimental results with these of calculations recently developed allows the solution of a certain number of problems concerning the transitions between nuclear levels and the interaction between nucleus and electrons. (auth)

6462

MIXTURE OF M_1 AND E_2 TRANSITIONS. N. Marty and H. Langevin (Collège de France, Paris). J. phys. radium **16**, 531-3(1955) July. (In French)

An attempt is made to see if the experimental evidence

of mixed M_1 - E_2 γ transitions, not explained theoretically by the one-particle model, can be related with the existence of rotational levels. Two tables are given of the mixed M_1 - E_2 radiations for odd A and even-even nuclei, with, in the first case, the coulombian excitation levels when they are known. (auth)

6463

ON THE NATURAL WIDTH OF CONVERSION ELECTRON LINES. Manuel Valadares (C.N.R.S., Bellevue). *J. phys. radium* **16**, 542-4(1955) July. (In French)

The relation which exists between the width of conversion lines and the width of x-ray absorption discontinuities is discussed. The knowledge of the natural width of conversion lines could contribute to the solution of a certain number of problems that are indicated. (auth)

6464

THE WIDTHS OF CONVERSION LINES. Milorad Mladjenović (Institut de recherches nucléaires, Belgrade). *J. phys. radium* **16**, 545-8(1955) July. (In French)

Measurements were made of the width of the principal lines of the internal conversion spectrum of RaB. Examination was made of the factors which could give the conversion lines widths different from those obtained by x-ray analyses. (auth)

6465

EXPERIMENTAL STUDY OF THE PERTURBATION CONVEYED TO THE ATOMIC SHELL BY β DISINTEGRATION AND ELECTRON CAPTURE. Georges Charpak (Collège de France, Paris). *J. phys. radium* **16**, 567-72(1955) July. (In French)

Analysis is made of experimental methods in the study of autoionization effects in β decay and K capture. Experiments on Fe^{55} and P^{32} show agreement with theory, except for a still unexplained tail of electrons above 5 kev, in coincidence with P^{32} β rays in five cases in a 1000, and whose half-thickness value is 0.2 mg/cm² Al. (auth)

6466

BREMSSTRAHLUNG ACCOMPANYING ELECTRON CAPTURE. R. J. Glauber and P. C. Martin (Harvard Univ., Cambridge, Mass.). *J. phys. radium* **16**, 573-4(1955) July. (In French)

The shape of the continuous γ -ray spectrum accompanying orbital electron capture has been computed taking Coulomb effects into account. Up to several times the characteristic x-ray energy, radiative capture of p electrons is more probable than that of s electrons. The large quantity of low-frequency radiation is in agreement with experiment. (auth)

6467

ON THE ANGULAR CORRELATIONS OF CONVERSION ELECTRONS, WITH A PARTICULAR STUDY OF THE CASCADE FROM Cd^{111} . Ernest Heer (École Polytechnique Fédérale, Zurich). *J. phys. radium* **16**, 600-4(1955) July. (In French)

The gamma-gamma angular correlation is an important tool in modern nuclear spectroscopy. It gives us the possibility of determining angular momenta of nuclear levels and multipole orders of gamma transitions. In principle, the same information can be obtained if the conversion electrons are measured instead of the γ rays. This procedure is especially well suited for reasons of intensity in cases of high conversion coefficients. The principal difficulty which then occurs is the problem of the source. This source must be sufficiently thin to avoid scattering of the electrons

and at the same time must show no influence of external fields on the angular correlation. Experiments with the cascade of Cd^{111} are described, where sources consisting of a thin liquid metallic film were used successfully. (auth)

6468

INFLUENCE OF THE PERIPHERAL ELECTRONS OF THE ATOM ON THE ANGULAR CORRELATION OF SUCCESSIVE NUCLEAR RADIATIONS. Ernst Heer (École Polytechnique Fédérale, Zurich). *J. phys. radium* **16**, 605-8(1955) July. (In French)

The influence of the magnetic dipole moment and the electric quadrupole moment of the electron shell on the angular correlation of successive nuclear radiations is discussed. As an example the experiments on the Cd^{111} γ - γ cascade are examined. It is shown that most of the observed effects can be explained by the electric quadrupole interaction with surrounding electric fields. In some cases magnetic dipole interaction with the excited electron shell may also be of importance. Methods are described to measure nuclear moments of excited states on one hand and to measure the undisturbed angular correlation on the other hand. (auth)

6469

NUCLEAR ORIENTATION AT LOW TEMPERATURE AND ITS APPLICATIONS. H. Halban (Clarendon Lab., Oxford, England). *J. phys. radium* **16**, 609-14(1955) July. (In French)

A number of methods of orienting nuclei have been conceived so far. They lead either to polarization or to alignment. Two of them have already lead to successful experiments. They both obtain orientation through magnetic hfs fields in paramagnetic substances. Radioactive nuclei oriented in this way show anisotropic emission of γ rays. A study of the anisotropy allows the multipole character of the γ -ray transition to be determined. The determination of the plane of polarization makes a distinction between magnetic and electric multipoles possible. In certain cases one can also determine the character of a β -ray transition preceeding the emission of γ rays. Future possibilities are discussed. (auth)

6470

ANGULAR DISTRIBUTION OF THE RADIATIONS EMITTED BY ORIENTED NUCLEI: THE INFLUENCE OF THE PRECESSION OF NUCLEAR SPINS IN INTERMEDIATE STATES, PARTICULARLY AFTER K CAPTURE. H. A. Tolhoek, Chr. D. Hartogh, and S. R. de Groot (Institut de Physique Théorique, Leyde (Pas-Bas)). *J. phys. radium* **16**, 615-21(1955) July. (In French)

Oriented nuclei may emit γ radiation with anisotropic angular distribution, which is mostly preceded by a β emission or K capture. The influence of the precession of the nuclear spin in the intermediate state is studied. After K capture a strong coupling between the nuclear spin and the remaining K electron exists, but its influence on the angular distribution is small, due to the short life time of the atomic intermediate state. (auth)

6471

SOME ASPECTS OF THE INFLUENCE OF THE ELECTRON SHELL ON THE EMISSION OF NUCLEAR RADIATIONS. M. A. Grace (Clarendon Lab., Oxford, England). *J. phys. radium* **16**, 622-4(1955) July. (In French)

It is shown that in the angular correlation of the γ rays in Ni^{60} , no influence arises through electronic relaxation phenomena. This result is considered in relation to nuclear

orientation experiments. The isotropic distribution of γ radiation from oriented Co^{57} nuclei is discussed. (auth)

6472

FLUORESCENCE YIELD. E. H. S. Burhop (Univ. Coll., London). *J. phys. radium* **16**, 625-9(1955) July. (In French)

It is shown that when allowance is made for screening and relativistic effects, the variation with Z of the fluorescence yield $\bar{\omega}$, is expected to be of the form $(\bar{\omega}/1 - \bar{\omega})^{1/2} = A + BZ + CZ^2$, where the constant A includes the effect of screening and C that of relativity. Values of A , B , and C are determined from a least squares fit of the K series fluorescence yield experimental data and values in good agreement with theoretical expectations are obtained. Values of A and B (assuming $C = 0$) are also obtained from a least square fit of the rather meager L series data. The best values for L and M series yield are also discussed. (auth)

6473

SPECTROGRAPHY OF FLUORESCENT RADIATIONS IN RADIOELEMENTS. Marcel Frilley (Laboratoire Curie, Paris). *J. phys. radium* **16**, 630-4(1955) July. (In French)

The ionization of electronic shells resulting from certain radioactive transmutations is followed by the emission of fluorescent photons. The K and L spectra are considered, and their energy and intensity and the information which can be obtained on the transitions generating them. (auth)

NUCLEAR REACTORS

6474 AECD-3645

Atomic Energy Commission, Washington, D. C.
THE REACTOR HANDBOOK. VOL. 1. PHYSICS. J. F. Hogerton and R. C. Grass, eds. [June 1953]. Decl. with deletions Feb. 1955. [Issued] Mar. 1955. 805p.

The first section consists of a discussion of reactor physics, including such topics as experimental methods, nuclear physics, kinetic theory of neutrons, and reactor statics and dynamics. The second section deals with radiation shielding and includes discussions of radiation sources, permitted levels of radiation, γ and neutron attenuation, shielding geometry, weight optimization of shielding, and shielding materials. (B.J.H.)

6475 AECD-3646

Atomic Energy Commission, Washington, D. C.
THE REACTOR HANDBOOK. VOL. 2. ENGINEERING. J. F. Hogerton and R. C. Grass, eds. [Sept. 1953]. Decl. with deletions May, 1955. [Issued] May 1955. 1083p.

Various phases of reactor engineering are discussed, specifically light- and heavy- water-cooled systems, liquid-metal-cooled systems, gas-cooled systems, aqueous fuel systems, liquid-metal fuel systems, fused-salt systems, handling and control, and reactor designs. (B.J.H.)

6476 AECD-3647

Atomic Energy Commission, Washington, D. C.
THE REACTOR HANDBOOK. VOL. 3. MATERIALS. SECTION 1. GENERAL PROPERTIES. J. F. Hogerton and R. C. Grass, eds. [Sept. 1953]. Decl. with deletions Feb. 1955. [Issued] Mar. 1955. 625p.

A brief discussion of the functions of reactor materials is first presented after which treatment is given of the general properties of certain materials including aluminum and its alloys, beryllia, beryllium and its alloys, beryllium

carbide, cements and concretes, graphite, hydrides, lithium and its alloys, magnesium and its alloys, molybdenum and its alloys, nickel and its alloys, plutonium and its alloys, the rare earths, silicon carbide, stainless steels, thorium and its alloys, titanium and its alloys, tungsten, uranium and its alloys, vanadium and its alloys, zirconium and its alloys, high-cross-section materials, and cobalt-base alloys. (B.J.H.)

6477 CRDC-596

Atomic Energy of Canada Ltd. Chalk River Project,
Chalk River, Ont.

OUT-REACTOR TESTS OF THE HTP LOOP. R. F. S. Robertson and P. G. Anderson. June 1955. 85p. (AECL-195)

A stainless steel loop is described in which H_2O was recirculated by a totally enclosed centrifugal pump. Temperatures up to 260°C were achieved by immersion heaters, and pressures up to 1000 psi were obtained by the use of an electrically heated surge tank. It was found that the surge tank could be used as a very efficient gas stripper. Rates of H_2 accumulation in the loop were measured at 260°C . If O_2 was injected into the loop water its concentration decreased rapidly for the first few hours and then more slowly. It was found that H_2 and O_2 dissolved in the loop water would combine at 260°C . Stainless steel specimens were placed in the loop and corrosion tests were run with various water conditions. Weight changes and changes in appearance of these samples are described. (auth)

6478 NAA-SR-Memo-685

North American Aviation, Inc., Downey, Calif.
U.P.R. CONTROL ROD LATCH. J. L. Hedgecock. Apr. 29, 1953. Decl. Apr. 14, 1955. 12p. Contract AT-11-1-GEN-8.

Four designs are presented for latches on control and safety rod drive units for the Uranium Production Reactor. The four types are compared, and performance curves are given. (M.P.G.)

6479 TID-5275

[Atomic Energy Commission, Washington, D. C.]
RESEARCH REACTORS. SELECTED REFERENCE MATERIAL. UNITED STATES ATOMIC ENERGY PROGRAM. 1955. 456p.

Extensive reference material is given on several types of research reactors, namely: the light-water-moderated, homogeneous fuel reactor; the light-water-moderated, heterogeneous fuel reactor; the light-water and oil-moderated, heterogeneous fuel reactor; the heavy-water-moderated, heterogeneous fuel reactor; and the graphite-moderated reactor. Topics discussed include descriptions of facilities, assemblies, control systems, performance, shielding, experimental facilities, etc. (B.J.H.)

6480

TURBINE CONTAMINATION CAUSES ONLY SMALL PROBLEM WITH BOILING-WATER REACTORS. Samuel Untermyer (General Electric Co., Schenectady, N. Y.). *Nucleonics* **13**, No. 8, 52, 54, 56, 58, 60(1955) Aug.

Various possible causes of contamination to turbines in boiling-water reactors are discussed, and estimates of radiation level in the turbine during overhaul are given. It is concluded that turbine contamination should present no problem during overhaul. (B.J.H.)

6481

SUDDEN CHANGES IN A HEAVY WATER REACTOR. E. Germagnoli and L. Mongini. *Energia nucleare (Milan)* 2, 323-32(1955) July 15. (In Italian)

Information on the behavior of materials submitted to intense neutron and gamma radiation is very important in planning nuclear reactors characterized by high neutron flux. Such considerations lead to limitations on the choice of materials used as constituent elements of a reactor. While the choice of materials from which to choose, for the construction of a reactor of relatively low power, is prescribed almost solely from the examination of their nuclear properties, it can happen that such considerations are of secondary importance and that fundamental results make it necessary that the materials introduced in the reactor be capable of supporting high-neutron flux for a long period of time, without undergoing serious alterations of their characteristic properties. One particularly interesting case is that of heavy water, whose behavior in a medium power reactor is examined. (tr-auth)

6482

THE DYNAMICS OF A THERMAL REACTOR WITH REFLECTOR. A. Ascari and L. Orsoni. *Energia nucleare (Milan)* 2, 345-64(1955) July 15. (In Italian)

The two basic dynamical parameters of a reflected thermal nuclear reactor, namely the generation time and the effective multiplication factor are calculated. In this first paper an analysis of the assumptions which simplify the calculations is given, and the generation time, both with one- and two-group theory, is calculated. (auth.)

6483

METALLURGY AND NUCLEAR ENERGY. Claude Decroly. *Bull. sci. A.I.M. (Belg.)*, No. 5, 371-91(1955) May. (In French)

A general discussion is given of the metals used in the construction of nuclear reactors. Included are discussions of the properties of the fissionable materials, natural uranium, enriched uranium, U^{235} , plutonium and thorium. Special construction materials are also discussed as to mechanical and metallurgical problems, heat conduction, and casings. The effect of radiations on metals and corrosion problems are also dealt with. (B.J.H.)

NUCLEAR TRANSFORMATION

6484 ISC-535

Ames Lab., Ames, Iowa.

PHOTODISINTEGRATION OF LIGHT ELEMENTS IN NUCLEAR EMULSIONS. Raymond D. Cooper and D. J. Zaffarano. July 1954. 28p. Contract W-7405-eng-82.

The cross sections for the reactions $C^{12}(\gamma,3\alpha)$ and $O^{16}(\gamma,4\alpha)$ have been measured as a function of photon energy from threshold to 50 Mev, and agreement with known levels is good in the former case. New levels are observed in the region 23 to 30 Mev for the latter reaction. The cross section for the reaction $N^{14}(\gamma,2\alpha) Li^6$ is observed to peak at 25 Mev, with a long tail to 45 Mev. The reaction $N^{14}(\gamma,np)3\alpha$ occurs at least four times as often as the reaction $N^{14}(\gamma,d)3\alpha$. (auth)

6485

ON THE ACTIVATION CURVE OF THE $P^{31}(\gamma,n)P^{30}$ REACTION NEAR THE THRESHOLD. Claude Schuhl and Robert Basile. *Compt. rend.* 240, 2512-14(1955) June 27. (In French)

The experimental results which have been obtained on the activation curve of the reaction $P^{31}(\gamma,n)P^{30}$ are discussed. These results permit a determination of the mass of P^{30} ($29.987822 \pm 0.000,095$ a.m.u.) and the maximum β^+ energy of this nucleus (3.23 ± 0.12 Mev). (tr-auth)

6486

STUDY OF RECOIL OF Cu^{62} OBTAINED BY THE REACTION $Cu^{63}(\gamma,n)Cu^{62}$. APPLICATION TO THE PREPARATION OF Cu^{62} WITHOUT AN ENTRAINING AGENT. Pierre Sue and Jules Pauly. *Compt. rend.* 241, 197-9(1955) July 11. (In French)

Cu^{62} is prepared without an entraining agent by irradiating metallic Cu with γ rays, where one of its salts, finely pulverized and mixed with a powder serves as a catcher for the recoil nuclei. The two products are separated, and Cu^{62} is isolated from the catcher with an attainable efficiency of 39%. The range of the recoil is about 0.26μ in $CuSO_4 \cdot 5H_2O$ and about 0.06μ in copper powder. (tr-auth)

6487

AN ACCURATE DETERMINATION OF THE ENERGY OF THE $D(d,n)^3He$ REACTION. Sonja Subotić and Bogdan Maglić (Inst. of Nuclear Sciences, Boris Kidric, Belgrade). *Phil. Mag.* (7) 46, 805-7(1955) July.

A method is described for the accurate measurement of the Q value of the $D(d,n)He^3$ reaction. Experiments yielded a value of 3.272 ± 0.023 Mev, which is compared with values obtained by other methods. (B.J.H.)

6488

THE EXCITATION OF THE $Li(\gamma,n)$ REACTION. F. Heinrich and R. Rubin (Univ. of Zurich). *Helv. Phys. Acta* 28, 185-92 (1955) May. (In German)

The activation curve of the (γ,n) reaction on Li^7 , measured in a previous investigation with a 31-Mev betatron, shows pronounced resonance type maxima. One can describe these experimental maxima by the appearance of highly excited intermediate states. The possibility also exists that a certain reaction shows minima and maxima in its partial effective cross sections, while the total absorption cross section of the corresponding nuclei depends only on the quantum energy. This case is evident when the considered reaction competes with other simultaneous photonuclear processes and the branching ratio of these reactions for fixed quantum energy form maxima and minima. In both the former cases it is not to be expected that the partial cross sections occurring in photonuclear reactions will show the same resonance type processes. To examine this question more accurately for Li^7 , the energy dependence of the effective cross sections for the $Li(\gamma,n)$ reaction is obtained. Since this Li^7 process yields stable Li^6 , its detection thus requires a direct measurement of the scattered neutron. A separation of this reaction from the simultaneous (γ,n) process appearing in Li^6 is not feasible. The sum of both reactions is measured, and the contribution of Li^6 is neglected. Proportional counter tubes with boron trifluoride fillings are used with advantage as neutron detectors for the betatron whose γ pulse (of period $10 \mu sec$) is very short compared with that of the radiation-free intervals ($\approx 1/50$ sec). Such a boron counter in the form indicated by Hanson has a wide range of sensitivity, independent of the incident neutron energy. As the retardation process in the counter lasts about 10 times longer than the betatron pulse, only an insignificant fraction of the released neutrons reach the boron counter. This condition is allowed

to stop the counter assembly for the short period of the gamma pulse, and thereby to avoid trouble with Bremsstrahlung quanta. (tr-auth)

6489

STUDY OF THE ${}_{17}\text{C}^{35}(\text{n},\text{p})_{16}\text{S}^{35}$ REACTION WITH A SPECIAL NUCLEAR EMULSION OF SILVER CHLORIDE. H. Berthet and J. Rossel. *Helv. Phys. Acta* **28**, 265-96(1955) May. (In French)

The slow neutron reaction $\text{Cl}^{35}(\text{n},\text{p})\text{S}^{35}$ has been studied with a new nuclear emulsion (prepared by Kodak) where all AgBr was replaced by AgCl. Sandwiches of normal (Ilford) and special Cl emulsions exposed to pile neutrons enable an accurate determination of the total flux through the $\text{N}^{14}(\text{n},\text{p})\text{C}^{14}$ reaction, and allow a direct comparison of the nearly equal Q values of the two processes by fitting gaussian curves for the two proton groups. The cross section for Cl was found to be $\sigma = 0.30 \pm 0.01$ barn. The relative difference of the Q amounts to 3.6%, in excellent agreement with the predicted Q values both from the masses and from the limit of β spectrum. Comparison of the measured ratio $\sigma(\text{n},\text{p})/\sigma(\text{n},\gamma)$ with theoretical predictions shows coincidence of the order of magnitude and favors the value $r_0 = 1.3 \times 10^{-13}$ cm in the expression $R = r_0 A^{1/3}$ for nuclear radius. Using the published experimental data on stopping-power energy relation for low energy protons in the elements, a calibration curve in the energy range $100 < E_p < 1000$ kev for Ilford emulsion has been established. So there is avoided any questionable use of α -particle values of stopping power. The agreement with measured proton ranges being excellent, the same procedure was applied for a calibration of the Cl emulsion. Finally a discussion of the useful precautions in determining cross sections with nuclear plates based on a careful chemical analysis of the emulsion is presented. (auth)

6490

THE RADIATIVE CAPTURE OF ALPHA PARTICLES IN ${}^{14}\text{N}$. P. C. Price (Cavendish Lab., Cambridge, England). *Proc. Phys. Soc. (London)* **A68**, 553-8(1955) July 1.

The $\text{N}^{14}(\alpha,\gamma)\text{F}^{18}$ reaction has been examined from 1.2- to 2.2-Mev bombarding energy. Two narrow resonances have been found; their positions have been measured, and upper limits obtained for their total widths. The cascade schemes at each resonance have been partly elucidated, and the position of another level involved in these cascades has been measured. The partial radiation widths of these resonances have been determined, except for a statistical factor. Some of the angular distributions have been studied, and conclusions have been drawn about the possible values of the spins and parities of the levels concerned. (auth)

6491

THE REACTION ${}^{11}\text{B}(\text{d},\text{n}){}^{12}\text{C}$. A. Ward and P. J. Grant (Univ. of Glasgow, Scotland). *Proc. Phys. Soc. (London)* **A68**, 637-43(1955) July 1.

Using scintillation-counter detection and pulse-height analysis, the angular distributions of the neutron groups from the reaction $\text{B}^{11}(\text{d},\text{n})\text{C}^{12}$ leading to the ground state and first excited state of C^{12} , have been determined at a deuteron bombarding energy of 600 kev. The results are compared with those predicted by the stripping theory and with those expected if the reaction proceeds by compound nucleus formation. The stripping mechanism appears to be important even at low bombarding energies for the ground-state group, but for the excited state the interpretation is less certain. (auth)

6492

A NOTE ON THE BRANCHING RATIO OF THE D-D REACTIONS. K. G. McNeill (Univ. of Glasgow, Scotland). *Phil. Mag.* (7) **46**, 800-4(1955) July.

Recently two papers have been published which contain results on the branching ratio of the two D-D reactions at variance with those of earlier workers. In this note it is suggested that this disagreement is due to the acceptance by the latter of incorrect values for the angular asymmetries of the reactions. On this assumption the experimental results have been recalculated using more recent data on the angular distribution, and it is found that the corrected values are in agreement with those of the more recently published results; that is, the 90° c.m. branching ratio, $\sigma(\text{dn})^3\text{He}/\sigma(\text{dp})^3\text{H}$, does not vary with deuteron energy, but the ratio of the total cross sections rises from 1.01 at 14 kev to 1.20 at 466 kev deuteron energy. (auth)

PARTICLE ACCELERATORS

6493 CERN-PS/KJ-28

[European Organization for Nuclear Research, Geneva]. THE EFFECT OF MISALIGNMENTS OF FOCUSING LENSES IN A LINAC. K. Johnsen. June 1955. 13p.

A theoretical discussion is given of the effect of misalignment of focusing lenses in linear accelerators. Alternating-gradient focusing is compared to solenoid focusing in detail. It is concluded that the effects of misalignment of quadrupoles is 4 to 5 times greater than the effects of solenoid misalignment. (B.J.H.)

6494 CERN-PS/MM-18

[European Organization for Nuclear Research, Geneva]. ETUDE DES PROPRIETES MAGNETIQUES DES TOILES DES AIMANTS DU SYNCHROTRON A PROTONS. (Study of the Magnetic Properties of the Magnet Plates of the Proton Synchrotron). [nd]. 40p.

6495 UCRL-1884(Rev.)

California. Univ., Berkeley. Radiation Lab. THE CLOVERLEAF THREE PHASE RADIOFREQUENCY SYSTEM. Bob H. Smith. Mar. 1955. Decl. June 6, 1955. 39p. Contract W-7405-eng-48.

Complete discussions, calculations, block diagrams, and circuitry are given for the three-phase r-f system used with the cloverleaf cyclotron. (B.J.H.)

6496 UCRL-2344(Rev.)

California. Univ., Berkeley. Radiation Lab. AN ELECTRON MODEL PHASE-COMPENSATED C-W CYCLOTRON. Robert Pyle. Mar. 1955. Decl. June 30, 1955. 85p. Contract W-7405-eng-48.

A 33-in. diameter cyclotron was constructed which accelerated electrons to $v/c = 0.46$ with a constant-frequency (61 Mc) voltage on the electrodes. The design was based on the theory that, with the introduction of a suitable azimuthal variation in the magnetic field, it would be possible for particles in all stable orbits to have the same period of revolution and, at the same time, adequate axial and radial focusing. The magnetic field of the cyclotron had 3 maxima and 3 minima. By slightly modifying the magnetic field at large radii, 90% of the circulating beam was extracted over a region 25° wide in azimuth. The performance of the cyclotron was sufficiently promising to encourage the building of a second electron cyclotron of higher energy. (M.P.G.)

6497

EXTRACTED PROTON BEAM OF THE LIVERPOOL 156-INCH CYCLOTRON. A. V. Crewe and K. J. De Couteur (Univ. of Liverpool, England). *Rev. Sci. Instr.* **26**, 725(1955) July.

A detailed description is given of a method for extraction of the proton beam of the Liverpool cyclotron. The method used was a regenerative system consisting of two magnetic discontinuities placed at the extraction radius and a magnetic channel placed between them. (B.J.H.)

6498

A HELICAL WAVE GUIDE FOR ACCELERATING PROTONS FROM 1 TO 10 MEV. R. Servranckx. *Bull. classe sci., Acad. roy. Belg.* **41**, No. 4, 474-85(1955). (In French)

The geometrical conditions of acceleration are studied. (Solution of the equation of motion of the particle taking account of losses due to the Joule effect and study of the conditions of longitudinal stability.) The influence of the variation of the slope of the spiral does not appear except in the second order in the equations of motion. (tr-auth)

6499

PHASE VELOCITY AND SHUNT IMPEDANCE OF A HELICAL WAVE GUIDE FOR A PROTON LINEAR ACCELERATOR (ENERGY ABOUT 50 MEV). Albert Septier. *Compt. rend.* **240**, 2500-2(1955) June 27. (In French)

Completing the previously obtained results on a suitable guide for energies in the 5-Mev region, a study is presented here of a second section usable in the neighborhood of 50 Mev, which permits appreciable increase of the shunt impedance of the guide. (tr-auth)

RADIATION ABSORPTION AND SCATTERING

6500 CVAC-243T

Consolidated Vultee Aircraft Corp., Fort Worth, Tex. A MONTE CARLO CALCULATION OF SCATTERING OF GAMMA-RAYS BY CONCRETE AND ALUMINUM. J. F. Perkins. July 9, 1954. 65p. (FZK-9-082)

The number and energy gamma-ray albedos of a material of $Z_{\text{eff}} = 13$, which includes both concrete and aluminum, and the spatial and spectral distribution of the scattered radiation were calculated using a random sampling technique. Incident angles of 0° , 45° , 60° , and 80° and a number of incident energies between 0.66 and 6 mev were treated, the only interaction processes considered being Compton scattering and photoelectric absorption. The calculations were performed on an IBM 701 computer, the requisite speed dictating operation in fixed point. The portions of the albedos arising from the first scattering and from all subsequent scatterings were calculated separately with the result that the first scattering usually contributes considerably less than half of the total; this holds for both number and energy albedos. The fractional probable error in the portion of the albedo arising from the first scattering is larger than in the other portion and, since the contribution from the first scattering is fairly easy to treat deterministically, it is felt that the most significant aspect of the present results is that concerned with the multiple-scattered component. The spatial distribution of the multiple-scattered component was found to be definitely anisotropic; in fact for small and moderate incident angles the distributions of the number dose and the energy dose per unit emergent solid angle are each rather adequately fitted by a factor proportional to the

cosine of the normal angle of emergence. Both the single- and multiple-scattered components were found to increase with the angle of incidence. The spectra peak around 150 to 250 kev and in some cases have a second peak at higher energy; such secondary peaks move upward in energy and increase in importance as the angle of incidence increases. The average energy of the emergent photons varies from 0.33 to 1.4 m_0c^2 . For the multiple-scattered component the average energy varies from 0.30 to 0.93 m_0c^2 . The variation with azimuthal angle peaks in the forward direction. This results largely from the single-scattered component, becoming more pronounced at higher angles of incidence. Buildup factors have been calculated for 2 m_0c^2 gammas normally incident on aluminum slabs of 2 and 4 mean free paths thickness. (auth)

6501 NYO-7102

Carnegie Inst. of Tech., Pittsburgh.

PHASE SHIFTS AND COULOMB INTERFERENCE EFFECTS FOR HIGH ENERGY PROTON-PROTON SCATTERING. Alper Garren. Jan. 1955. 101p. Contract AT(30-1)-882.

Certain high-energy proton-proton scattering and polarization experiments are analyzed in terms of s and p wave phase shifts. Coulomb interference is treated including relativistic and anomalous magnetic moment effects. Various possible triple scattering experiments are examined in terms of the phase shift analysis, and related neutron-proton data are discussed in terms of phase shifts. (auth)

6502 TPI-70

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

GRAPHS OF COULOMB FUNCTIONS. W. T. Sharp, H. E. Gove, and E. B. Paul. July 29, 1953. 68p.

In applications the Coulomb functions $F_L(\rho)$ and $G_L(\rho)$ occur most often in the combinations $A_L^2 = F_L^2 + G_L^2$, $B_L^2 = F_L'^2 + G_L'^2$, and $\phi_L = \tan^{-1} F_L/G_L$, where the primes indicate differentiation with respect to ρ . Graphs of the functions A_L^2 , B_L^2 , ϕ_L are presented for $L = 0, 1, 2, 3, 4$ for a range of parameters appropriate to the reactions of low energy protons with light and medium weight nuclei. Also included are some auxiliary graphs useful in the applications of the Coulomb functions to penetrability and scattering calculations. (auth)

6503

THE SELECTION OF POTENTIALS IN NUCLEON-NUCLEAR SCATTERING PROBLEMS. G. C. Morrison, H. Muirhead, and P. A. B. Murdoch (Univ. of Glasgow, Scotland). *Phil. Mag.* (7) **46**, 795-9(1955) July.

It is shown that the magnitudes of the real and imaginary potentials employed in nucleon-nuclear scattering problems may be qualitatively predicted with the aid of data on free nucleon-nucleon scattering, and a Fermi gas model of the nucleus. (auth)

6504

NEUTRON-DEUTERON SCATTERING IN THE RANGE 80-200 KEV. W. D. Allen, A. T. G. Ferguson, and J. Roberts (Atomic Energy Research Establishment, Harwell, Berks, England). *Proc. Phys. Soc. (London)* **A68**, 650-4(1955) July 1.

A proportional counter method is described for observing the distribution of pulses from protons and deuterons recoiling from neutron impact. Angular distributions of neutrons recoiling from deuterium and of protons recoiling

from neutron impact are given, and scattering cross sections are given. (B.J.H.)

6505

ELASTIC SCATTERING AT LARGE ANGLES OF PROTONS IN A SYNCHROTRON. Joseph Seiden. *Compt. rend.* **240**, 2519-20(1955) June 27. (In French)

It is shown that the loss of synchrotron protons by the mechanism of "simple scattering," whereby the proton is scattered through a large angle at the beginning of its acceleration, is appreciable. (B.J.H.)

6506

INELASTIC SCATTERING OF NEUTRONS BY A SINGLE CRYSTAL. A. Herpin and B. Jacrot (Commissariat à l'Énergie Atomique, Paris). *J. phys. radium* **16**, 35s-9s (1955) July. (In French)

An experiment is described which is aimed at measuring the variation of energy of very slow neutrons in inelastic scattering by a monocrystal. A time-of-flight spectrometer was used for this, the incident neutrons being made roughly monoenergetic by a crystalline or mechanical filter. The difficulty of the experiment arises from the low intensity of the neutrons. The variation of the effective cross section for inelastic scattering has been calculated as a function of the direction of observation for a given incident direction (100° , for example). The calculations, using Feynmann's technique in field theory, allow one to arrive at the process of only one phonon as well as those of more phonons. These last present the character of a continuous background. For the wave lengths used, only hyperelastic phenomena interfere; one can calculate one order of magnitude of the increase of neutron energy in the collision, by using the Debye model of the crystal. But it is known that this model is very rough. It is thought, then, that the experiment will be able to give precise data on the form of the dispersion curve and in a more direct manner than x rays. (tr-auth)

RADIATION EFFECTS

6507 AECU-3028

Michigan. Univ., Ann Arbor. Engineering Research Inst.

OPERATION OF THE FISSION PRODUCTS LABORATORY. QUARTERLY PROGRESS REPORT NO. 1 FOR THE PERIOD JANUARY 1, 1955 TO MARCH 30, 1955. L. E. Brownell, J. V. Nehemias, and J. J. Bulmer. May 1955. 27p. Contract AT(11-1)-162.

The design of a mashbox to be used for feeding irradiated wet mash to pullets is given. An extensive discussion of flour irradiation is also given, including the effect of radiation on insects as a possible method of controlling insect infestation of flour, the effect of γ radiation on the baking quality of wheat flours, types of facilities for flour irradiation with special emphasis on the use of cooling reactor-fuel elements as a radiation source, methods of radiation dose measurements, and cost estimates of such an irradiation facility. (B.J.H.)

6508 NARF-55-55T(Vol.1, Pts.1 and 2)

Consolidated Vultee Aircraft Corp., Fort Worth, Tex. ACTIVATION HANDBOOK FOR AIRCRAFT DESIGNERS. Volume 1, Parts 1 and 2. K. B. Carver, W. E. Ivie, Jr., A. M. Liebschutz, and G. S. Weller. July 1, 1955. 726p. (FZK-9-089)

Parts 1 and 2 were issued separately but are cataloged as a unit.

This handbook contains the thermal neutron gamma activation tables of 169 aircraft alloys for various irradiation and decay times. (B.J.H.)

6509

EFFECT OF ATOMIC-PILE RADIATION ON THE ELASTIC MODULUS OF AN AUSTENITIC STEEL. A. Charlesby, N. H. Hancock, and H. C. Sansom (Atomic Energy Research Establishment, Harwell, Berks, England). *J. Nuclear Energy* **1**, 264-73(1955) June.

A sensitive method has been designed for measuring changes in the elastic modulus of a metal during irradiation in an atomic pile. The behavior of "Elinar," an austenitic alloy, has been studied at 62° and 70°C over a period of up to eight weeks' irradiation in an atomic pile (i.e., for a total integrated flux of 10^{19} neutrons/cm²). Over a period of three weeks' irradiation there was a decrease of less than 0.1% in the elastic modulus of two specimens, and about 0.3% in a third specimen. Further irradiation to six weeks restored the elastic modulus to its original value. The change in modulus of the various springs tested is not considered to be statistically significant. (auth)

6510

ČERENKOV RADIATION AND ITS APPLICATIONS. J. V. Jelley (Atomic Energy Research Establishment, Harwell, Berks, England). *Brit. J. Appl. Phys.* **6**, 227-32(1955) July.

A brief review is first presented of the original discovery of the radiation and the physical principles of the process that gives rise to it. This is followed by an elementary account of the theory of the effect. A general survey of the practical applications to cosmic-ray and high-energy physics is then presented, with two examples of modern detectors discussed in greater detail. The article concludes with an account of recent experiments carried out on light pulses from the night-sky associated with cosmic-ray showers, found to be due to Cherenkov radiation in the atmosphere. (auth)

RADIOACTIVITY

6511 UCRL-3038

California. Univ., Berkeley. Radiation Lab. RELATIVE INTENSITY AND INTERPRETATION OF SOME ELECTRON LINES IN Cm^{243} . James F. Schooley. June 24, 1955. 4p. Contract W-7405-eng-48.

The β -ray spectrum of Cm^{243} has been studied using a double-focusing β -ray spectrometer with a Geiger tube. Three K lines of transitions from the 277-kev level were observed, and their relative intensities were determined. L conversion lines were not clearly distinguishable, but lower limits were set on the K/L conversion ratios. Data were obtained on L conversion lines of the transition from the 321-kev level to the 277-kev level. (M.P.G.)

6512 AEC-tr-2196

β^+ - β^- -DECAY IN Br^{80} . B. S. Dzhelepov, N. M. Antonieva, and S. A. Shestopalova. Translated from *Doklady Akad. Nauk S.S.S.R.* **64**, 309-12(1949). 7p.

The spectrometer and experimental procedures which were used to analyze the competing β^+ and β^- decays in Br^{80} are described. Results give the ratio of β^+/β^- as $1.0 \pm 0.2\%$. On the basis of the experimental data, a decay scheme for Br^{80} is proposed. (B.J.H.)

6513 AERE-Lib/Trans-458**A COMPARISON OF THE SENSITIVITIES OF DIFFERENT METHODS OF MEASUREMENT FOR RADIO CARBON.**

M. Reinharz, G. Rohringer, and E. Broda. Translated by F. Hudswell from *Acta Phys. Austriaca* 8, 285-8(1954). 4p. (AERE-Trans-11/3/5/458)

The sensitivities of eleven different methods of measurement for radiocarbon are compared on the basis of either the smallest specific or total activity which is capable of being measured. Results are tabulated and discussed. (B.J.H.)

6514

THE FLUORESCENCE YIELDS OF THE L LEVELS OF BISMUTH. M. A. S. Ross, A. J. Cochran, J. Hughes, and N. Feather (Univ. of Edinburgh). *Proc. Phys. Soc. (London)* A68, 612-24(1955) July 1.

This paper is a supplement to the discussion by Kinsey of the fluorescence yields of the L sub-shells in the heavy elements; it suggests the use of experimental measurements other than those which he discussed for the calculation of these quantities. New observations are reported and collated with existing information. The fluorescence, Auger and Coster-Kronig yields of Bi are re-calculated. Suggestions are made about further experimental work. The numerical results are, for the fluorescence yields of Bi, $\omega_1 = 0.12 \pm 0.01$, $\omega_2 = 0.32 \pm 0.04$, $\omega_3 = 0.40 \pm 0.05$, for the Auger yields $a_1 = 0.11 \pm 0.03$, $a_2 = 0.62 \pm 0.14$, $a_3 = 0.60 \pm 0.05$, and for the Coster-Kronig yields $f_{12} = 0.19 \pm 0.05$, $f_{13} = 0.58 \pm 0.05$, $f_{23} = 0.06 \pm 0.14$. A discussion is added on some aspects of the radioactive disintegration of RaD. (auth)

6515

A SURVEY OF THE NATURAL GAMMA RADIOACTIVITY IN THE WEST CUMBERLAND AREA. D. R. R. Fair and H. Howells (United Kingdom Atomic Energy Authority, Windscale Works, Sellafield, Cumberland). *J. Nuclear Energy* 1, 274-9(1955) June.

The need for the determination of the natural gamma radioactivity levels in the West Cumberland area is outlined. The equipment used is described and the survey technique is specified. The results of the survey are listed and discussed. (auth)

6516

SCINTILLATION SPECTROMETER STUDIES ON THE BETA-ACTIVITY OF K^{40} . Soji Kono (Tokyo Univ. of Education). *J. Phys. Soc. Japan* 10, 495-7(1955) July.

The beta spectrum of K^{40} has been studied using the scintillations from a potassium iodide crystal activated with thallium iodide. The Kurie plot of the spectrum gave the forbidden shape, which was straightened from the end-point 1320 ± 20 kev down to well below 300 kev by the third forbidden tensor (or axial vector) correction factor. Measurement on the specific activity has also been carried out and resulted in the value $\lambda(\beta) = 5.0 \pm 0.2 \times 10^{-10}$ per year. This value is in good agreement with recent determinations. (auth)

6517

ON THE SPECTRUM OF POSITRONIUM IN EXTERNAL FIELDS. V. N. Tsytovich (Moscow State Univ.). *Zhur. Eksptl'. i Teoret. Fiz.* 28, 664-78(1955) June. (In Russian)

6518

HOW TO FIGURE SHAPES OF BETA-RAY SPECTRA. John H. Marshall (Massachusetts Inst. of Tech., Cambridge). *Nucleonics* 13, No. 8, 34-8(1955) Aug.

Two sets of graphs are given from which shapes of allowed and first-forbidden β spectra may be found, given the atomic number of the emitter and its maximum β energy. Graphs are also given for quick determination of the zero-energy ordinate of allowed spectra and the average energy of allowed energy spectra. (B.J.H.)

6519

ON THE EMISSION OF PHOTONS IN THE BLOCH AND NORDSIECK APPROXIMATION. R. Ascoli (Univ. of Torino, Italy). *Nuovo cimento* (10) 2, 1-10(1955) July. (In Italian)

The characteristic properties of the emission of an infinite number of photons which occurs according to the Bloch and Nordsieck treatment in all the processes in which a charged particle undergoes a transition from a definite momentum state to another definite momentum state are investigated. For electronic charges, the probability for one of these photons to fall in the frequency range that is of interest in ordinary experiments is found to be no more than some hundredths, in agreement with the perturbation method. This probability, however, may approach unity at very high energies in nuclear events of cosmic rays. The results, moreover, depend strongly upon the value of the charge and the probability for nuclear charges to emit several photons is considerably increased. In the case of macroscopical charges multiple emission usually occurs. (auth)

6520

REMARKS ON LOW-ENERGY GAMMA-RADIATION AT GREAT DEPTHS. M. Miesowicz, L. Jurkiewicz, and J. M. Massalski (Laboratory of Nuclear Physics, Cracow, Poland). *Nuovo cimento* (10) 2, 152-4(1955) July. (In English)

Low-intensity isotropic γ radiation producing double coincidences in a G-M counter telescope was studied and found to be independent of cosmic-radiation intensity but due only to local γ radiation. Data are tabulated and a mechanism of registering the double coincidences is suggested. (B.J.H.)

6521

ON LOW-ENERGY GAMMA RADIATION AT GREAT DEPTH. M. Ageno (Istituto Superiore di Sanita, Rome). *Nuovo cimento* (10) 2, 160-1(1955) July. (In Italian)

Some remarks are made on the previous note concerning low-energy gamma radiation at great depths and another mechanism for its occurrence is suggested. (See preceding abstract). (B.J.H.)

6522

ON THE β^- -DECAY OF ^{171}Tm . A. Bisi, S. Terrani, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). *Nuovo cimento* (10) 2, 172(1955) July. (In English)

The β spectrum of Tm^{171} was observed with an intermediate-image β spectrometer. Results show the end point of the spectrum to be at 103 ± 2 kev, and the shape of the spectrum to be allowed. (B.J.H.)

6523

BETA-GAMMA DIFFERENTIAL ANGULAR CORRELATION OF CHLORINE 38. P. Macq. *Bull. classe sci., Acad. roy. Belg.* 41, No. 4, 467-73(1955). (In French)

In a preceding work, evidence was shown for a phenomenon of angular correlation, integrated over the entire β energy spectrum, in the β - γ cascade of Cl^{38} . In order to determine the exact interpretation of such a phenomenon, the study was again made of this same cascade for 10 different β -particle energies. (tr-auth)

6524

IONIZING PARTICLES ISSUING FROM THE ACTIVE DEPOSIT OF ACTINIUM AND RECORDED BY PHOTOGRAPHIC EMULSIONS. Marie Ader. Compt. rend. **240**, 2138-40 (1955) June 1. (In French)

6525

STUDY, BY MEANS OF α - e^- COINCIDENCE METHOD, OF THE EMISSION OF ELECTRONS ACCOMPANYING THE α RADIATION OF Po^{210} . Maurice Duquesne. Compt. rend. **241**, 36-7 (1955) July 4. (In French)

A method is described for obtaining α - e^- coincidences in the α disintegration of Po^{210} . In particular, information was obtained concerning autoionization electrons accompanying the α decay. This method is not sensitive to any conversion electrons. The data obtained is used to explain the presence of x rays from excited Pb^{206} . (B.J.H.)

6526

VARIATIONS OF THE NATURAL AND ARTIFICIAL RADIOACTIVITY OF THE ATMOSPHERE. Olga Tanaevsky and Etienne Vassy. Compt. rend. **241**, 38-40 (1955) July 4. (In French)

The continuous recording of radioactivity in air shows an accumulation of radon content in most cases where the atmosphere is calm, disappearing as soon as the least wind reappears. The radioactivity of rain water, gathered with a special pluviometer, is occasionally very important; the half lives of the elements indicate their artificial origin. (tr-auth)

6527

L CAPTURE AND THE MEASUREMENT OF THE L TO K CAPTURE RATIO. SOME EXPERIMENTS WITH Kr^{79} . DISCUSSION OF THE PRESENT STATE OF THE QUESTION. Pierre Radvanyi (Collège de France, Paris). J. phys. radium **16**, 509-15 (1955) July. (In French)

L to K capture ratio of Kr^{79} was measured with a cloud chamber and with a proportional counter and found to be higher than expected theoretical value. Possible reasons for such a disagreement are discussed. Other results would not be in contradiction with hypothesis of a systematic discrepancy with theory. (auth)

6528

PROPORTIONAL COUNTER MEASUREMENT OF THE L TO K CAPTURE RATIO OF Kr^{79} . Michel Langevin (Collège de France, Paris). J. phys. radium **16**, 516-19 (1955) July. (In French)

L to K capture ratio of Kr^{79} was recently measured by use of a mixture of the radiative element with propane in a proportional counter. Some details are given on experimental procedure and results. (auth)

6529

INTERNAL CONVERSION COEFFICIENTS DURING ISOMERIC TRANSITIONS OF SOME STABLE NUCLEI. I. Antonova and U. Estulin (Univ. of Moscow). J. phys. radium **16**, 534-7 (1955) July. (In French)

Determination was made of internal conversion coefficients for isomeric transitions of Sr^{87*} , In^{113*} , In^{115*} , using absolute intensity countings measured with two ionization chambers, one thimble shaped for the β , the other one slit shaped for the γ . Results are in agreement with other experimental measurements but disagree with theoretical values. (auth)

6530

NATURAL RADIOACTIVITY OF LUTETIUM, RHENIUM

AND OSMIUM. D. Dixon, A. McNair, and S. C. Curran (Univ. of Glasgow, Scotland). J. phys. radium **16**, 538-40 (1955) July. (In French)

Some studies of the decay of Lu^{176} have been made with the help of the large proportional tube spectrometer and scintillation spectrometers. Sources down to 0.1 mg/cm^2 in thickness were spread over the large cathode and the shape of the β continuum, end-point $425 \pm 25 \text{ kev}$, together with the internal conversion peaks were observed. The conversion coefficients were evaluated. The γ ray spectrum and the γ - γ coincidence spectra showed that γ rays of energies 310, 190 and 89 kev were emitted in cascade. They arose in transitions from levels of spin and parity 6^+ , 4^+ , and 2^+ . The decay scheme fitted accurately the Bohr-Mottelson predictions. The ground state of Lu^{176} seemed to be a 10^+ state. The maximum branching by K-capture was 3%. The half life was 4.56×10^{10} years for Lu^{176} . Studies on Re^{184} and Os^{184} failed to reveal β -activity or capture and minimum half-lives of 10^{16} years were deduced. Apparent evidence of capture in Os^{184} was found to be due to a specific "background" effect and this effect could explain weak capture activities, for instance that tentatively assigned to In^{113} . Work on Na^{22} by Moljk, with extremely thin sources in the proportional tube, is important in the general problem of observing very soft Auger electrons released in capture decay. The position spectrum was found to be closely allowed in shape down to 15 kev or less. The capture intensity, as examined by searching for Auger electrons, was not more than 3%. There is still some uncertainty about the release of extremely soft electrons from such sources. Experiments of Moljk and Curran on C^{14} and S^{35} as gaseous sources (CH_4 and CS_2) showed that both spectra were allowed in shape to better than 1% down to an energy of about 2 kev. New techniques for such examination were described. (auth)

6531

INFLUENCE OF THE PHYSICAL STATE ON THE PERIOD OF Be^7 . R. Jacques. J. phys. radium **16**, 549-55 (1955) July. (In French)

With the view to calculate the variation of the half life of the Be^7 between the gaseous and the solid state, the electronic wave-function of the metallic Be is determined by three methods. The 3 d method, more precise, gives a variation of about 4%. The energies obtained agree with those determined by other authors and with experimental data. (auth)

6532

EFFECTS OF RADIOACTIVE DISINTEGRATIONS ON THE ELECTRONS OF THE INTERNAL SHELLS OF THE ATOM. J. S. Levinger (Louisiana State Univ., Baton Rouge). J. phys. radium **16**, 556-61 (1955) July. (In French)

The probability of emission of atomic electrons due to beta decay is proportional to $1/Z^2$ in accord with results of many workers. The value given for the emission probability due to alpha decay is smaller than that calculated by Migdal, or Schaeffer. The approximations are discussed. (auth)

6533

RECENT RESEARCH ON THE RADIOACTIVITY OF A^{37} . Aage Winther (Univ. of Copenhagen, Denmark). J. phys. radium **16**, 562-6 (1955) July. (In French)

A discussion is given on a recent experiment by O. Kofod-Hansen on the electron capture in A^{37} . The experimental K to L capture ratio is in strong disagreement with

the theoretical. It is proposed that this may be due to the use of electron wave functions which does not explicitly depend on the relative distance between the electrons. Also a new treatment of the final ionization of the daughter atom is produced. (auth)

6534

EVIDENCE FOR SOME LINES OF REARRANGEMENT CONSECUTIVE TO SELF IONIZATION FOLLOWING β DISINTEGRATION. G. A. Renard (Collège de France, Paris). *J. phys. radium* **16**, 575-7(1955) July. (In French)

Measurements were made by proportional counting of the K x rays of P^{32} , K and L of $Sr^{90} \rightarrow Y^{90}$, in equilibrium, L and M of RaE, following aut ionization. Most of the values obtained are compatible with theoretical values. (auth)

6535

BREMSSTRAHLUNG AND IONIZATION ACCOMPANYING β EMISSION OF Y^{90} AND RaE. A. Michalowica and R. Bouchez (Institut du Radium and Univ. of Paris). *J. phys. radium* **16**, 578-82(1955) July. (In French)

With the aid of a NaI (Tl) scintillation spectrometer the internal Bremsstrahlung and the atomic ionization for the forbidden transitions Y^{90} and RaE have been studied. The results on the Bremsstrahlung are in accord with the simplified theory of Knipp and Uhlenbeck; those on the K ionization with the formula of Levinger $0.92/Z^2$ while that of Migdal $0.64/Z^2$ gives a value too small. (auth)

6536

EXPERIMENTAL STUDY OF INTERNAL IONIZATION IN α EMISSION. Michel Riou (Institut du Radium, Paris). *J. phys. radium* **16**, 583-8(1955) July. (In French)

A review is given of the results on α disintegration of Po^{210} , the most favorable example for the observation of internal ionization. Intensities of K and L rays of lead and of the γ ray of 800-kev emitted by Po^{210} were determined. A deduction of the experimental probabilities of internal ionization of K and L shells, comparison with theory, and results on the electrons emitted by Po^{210} are given. (auth)

6537

STUDY OF THE REORGANIZATION ENERGY OF THE ELECTRON SHELL IN β AND α RADIOACTIVE PHENOMENA. P. Benoist-Gueutal (Institut du Radium, Paris). *J. phys. radium* **16**, 595-9(1955) July. (In French)

Corrections appearing in the theoretical study of β and α radioactivity are given when one considers the presence of the electrons of the emitting atom: (1) in the equations of conservation of energy, and (2) in the calculation of the emission probability of an electron or an α particle. (auth)

6538

A STUDY OF L LEVEL AUGER ELECTRONS EMITTED DURING THE DISINTEGRATION OF Au^{199} . S. K. Haynes and W. T. Achor. *J. phys. radium* **16**, 635-7(1955) July. (In French)

The L Auger yield of Au^{199} has been studied in a β -ray spectrometer. The ratio of L Auger electrons to L vacancies was 0.629 ± 0.035 . Insufficient resolution and uncertain $L_I \rightarrow L_{III}$ Coster-Kronig yield prevented determination of precise L subshell Auger yields. Approximate values of 0.577 ± 0.09 and 0.658 ± 0.01 were obtained for the L_{II} and L_{III} subshells respectively. (auth)

6539

AUGER ELECTRONS FROM ThB. Milorad Mladjenović and Hilding Slätis. *J. phys. radium* **16**, 638-9(1955) July. (In French)

Recent results on the energy and intensity of the K Auger lines of ThB are given and compared with theory. (auth)

6540

THE COMPLEX BETA TRANSFORMATIONS OF Na^{25} AND Al^{25} . D. Maeder and P. Staehelin. *Helv. Phys. Acta* **28**, 193-226(1955) May. (In German)

The 1 min activity of Na^{25} , produced by irradiation of Mg in the betatron, has been investigated using scintillation techniques for the measurement of β - and γ -ray energies. The single pulse spectrum from a NaI(Tl)-crystal, as recorded in the exponential sweep photographic pulse spectrometer, is analyzed into 4 γ -rays of 384 ± 10 , 576 ± 10 , 978 ± 15 , and 1603 ± 20 kev. The pulse height distribution from an anthracene crystal yields an end-point energy of 4.0 ± 0.2 Mev for the β transition to the ground state of Mg^{25} . Analysis of the β spectrum into partial transitions to the excited states of Mg^{25} is performed by means of β - γ coincidence studies. The evaluation of β - γ coincidences from Na^{25} shows that 65%, 3.5%, 25%, and 6.5% of the transitions lead to the ground state and to the first three excited states of Mg^{25} . From the ft values we conclude that Na^{25} has spin $3/2^+$, which means that the well-known spin anomaly of the stable nucleus Na^{23} occurs also in Na^{25} . In the short-lived activities of Al^{25+26} , obtained by proton bombardment of Mg in the cyclotron we have found a weak γ ray of 1.58 ± 0.03 Mev. The γ : β ratio indicates a normal allowed transition from Al^{25} to the 1.6-Mev level in Mg^{25} , which therefore must be either a $3/2^+$ or $5/2^+$ state. Qualitative arguments lead to a $(d_{5/2})^3 (d_{3/2})^2$ assignment for this level. Investigations of the stripping reactions on Mg^{24} by Holt and Marshall (d, p) and by Goldberg (d, n) have demonstrated the single-particle properties of at least five even parity levels below 3 Mev, in both Mg^{25} and Al^{25} . The results of the present work fix the spin value of the second excited state in Mg^{25} uniquely $(3/2^+)$, thus confirming the predictions of the nuclear shell model for the lowest three levels. For the production of the other single-particle states (excitation energies between 1.9 and 3 Mev) in direct stripping processes, a mechanism combining ordinary stripping with electric excitation of the Mg^{24} core is suggested. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

6541 ORNL-1917

Oak Ridge National Lab., Tenn.

A STUDY OF X-RAY FLUORESCENCE FOR THE ANALYSIS OF RARE EARTHS AND OTHER COMPLEX GROUPS. H. W. Dunn. June 7, 1955. 30p. Contract W-7405-eng-26.

The feasibility of accurate determination of rare earths and fourth period elements by means of x-ray fluorescence has been investigated. Experimental techniques are described, and the magnitude of the interferences due to excitation and absorption has been estimated. It is concluded that direct analysis of rare earths or other complex groups of elements is difficult to obtain by the x-ray fluorescence method, although fairly good accuracy can be obtained for high concentrations. Under certain conditions it may be possible to obtain a fairly accurate determination of concentrations as low as 1% on some complex mixtures. (M.P.G.)

6542 AERE-Lib/Trans-492

CRYSTAL HYPERFINE STRUCTURE IN THE SPECTRUM

OF PRASEODYMIUM SALTS. A. M. Hellwege and K. H. Hellwege. Translated by R. S. Forsyth from *Z. Physik* 135, 615-19(1954). 4p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 8-1447.

SHIELDING

6543 ATT-160108

North Carolina State Coll., Raleigh.

MECHANICAL AND PHYSICAL PROPERTIES OF BARYTES-COLEMANITE CONCRETE (thesis). Gustav Edward Lundquist. 1952. 37p.

Results of tests described show barytes-colemanite concrete has appreciably better shielding properties than ordinary concrete. For 1.8-Mev gamma rays the half-thickness of barytes-colemanite concrete was estimated to be 31.6 gm per cm² compared to 45.9 gm per cm² for ordinary concrete. For slow neutrons, its "half-thickness" was estimated to be 3.82 gm per cm² compared to 7.56 gm per cm² for ordinary concrete. Addition of boron-containing colemanite greatly improves neutron attenuation properties of the concrete. The barytes aggregate as received lacks sufficient fine particles; in general, physical properties of barytes-colemanite concrete compare very favorably with ordinary concrete. Since barytes-colemanite concrete has all advantages of ordinary concrete plus advantages of greater density and better radiation attenuation properties barytes-colemanite concrete is considered a useful, effective material for the shielding of a stationary nuclear reactor. (auth)

SPECTROSCOPY

6544 AEC-tr-2194(p.E1-2)

INFLUENCE OF TEMPERATURE ON THE IMPACT BROADENING OF THE RESONANCE LINE OF MERCURY (condensation). G. A. Gorodnichus. Translated from *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* 18, 255-6(1954). 2p. Available from Columbia Technical Translations, White Plains, N. Y.

The investigation of impact broadening of the resonance line of mercury was carried out by the method of photographic photometry. Results do not agree with the predictions of theory. (B.J.H.)

6545

ABSORPTION AND EMISSION SPECTRA OF BISMUTH-ACTIVATED PHOSPHORS. W. A. Runciman (Atomic Energy Research Establishment, Harwell, Berks, England). *Proc. Phys. Soc. (London)* A68, 647-9(1955) July 1.

Equations for the frequencies in the absorption and emission spectra of bismuth-activated phosphors, CaO(Bi) and SrO(Bi) are given. The spectra are discussed in some detail. (B.J.H.)

THEORETICAL PHYSICS

6546 NP-5726

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

QUARTERLY PROGRESS REPORT NO. 17. July 15, 1955. 43p. Contract N5ori-07856.

A theoretical discussion is given on the behavior of energy bands near points of degeneracy. The programming of the problem of an augmented plane wave method applied to calculation of energy values of sodium is discussed fully. The study of the electronic structure of the V center in KCl is described. Results of the study of interaction of states in the lithium hydride molecule are given. Work on the electronic energy of the OH molecule is described. Work on the polarization effects in the fluorine ion is continuing. Programs for Whirlwind are available for carrying out computational processes for obtaining approximate atomic wave functions. A one-center method for calculation of electronic wave functions of molecules is described. Configuration interactions, paired electron bonds, and electron lattice interactions are also discussed. (For previous period see NP-5622.) (B.J.H.)

6547

ON THE RELATION BETWEEN RELAXATION TIME AND THE PROBABILITIES OF TRANSITION IN NUCLEAR RESONANCE (MAGNETIC AND QUADRUPOLE). II. Francois Lurcat. *Compt. rend.* 240, 2517-18(1955) June 27. (In French)

6548

ON THE COLLECTIVE MOTIONS OF ROTATION OF NUCLEI. Roger Nataf. *Compt. rend.* 241, 31-3(1955) July 4. (In French)

In a previous note, the transformation of the spatial coordinates $\vec{x}_1, \dots, \vec{x}_A$ to the Θ_i coordinates defining the intrinsic axes of A. Bohr, and $\vec{x} \cdot \dots \vec{x}_{A-1}$ relative to these axes, was carried out on the nuclear Hamiltonian, following the method indicated. Here the properties of the transformed Hamiltonian and the possibility of applying the method are examined. (tr-auth)

6549

PERTURBATIVE EXPANSIONS. E. R. Caianiello (CERN Theoretical Study Division, Copenhagen, Denmark). *Nuovo cimento* (10) 2, 155-9(1955) July. (In English)

Further results on the explicit perturbative expansions of any element of the U matrix pertaining to the usual field theory are given. (B.J.H.)

6550

ON THE IMAGINARY PART OF THE NUCLEON-NUCLEUS POTENTIAL. E. Clementel and C. Villi (Univ. of Padova and Trieste, Italy). *Nuovo cimento* (10) 2, 176-9(1955) July. (In English)

Some of the nuclear models used to describe nucleon-nucleus interactions are reviewed, with particular attention being given to the clouded crystal ball model in which the nucleus is replaced by a complex attractive potential $V = V_0 + iV_1$. On the basis of this model, interaction cross sections are calculated and an expression for V_1 is obtained. The dependence of V_1 on E_0 for $V_0 = 33$ Mev is tabulated. (B.J.H.)

6551

ON THE COMPTON EFFECT AND MUTUAL SCATTERING OF PARTICLES AT HIGH ENERGIES IN QUANTUM ELECTRODYNAMICS AND PSEUDOSCALAR THEORY. A. A. Abrikosov (Vavilov Inst. of Physical Problems). *Doklady Akad. Nauk S.S.S.R.* 102, 1097-8(1955) June 21. (In Russian)

6552

COVARIANT TREATMENT OF THE NUCLEON-NUCLEON INTERACTION. H. S. Green (Univ. of Adelaide, South

Australia). Proc. Phys. Soc. (London) **A68**, 577-84(1955) July 1.

An approximate covariant solution of the Salpeter-Bethe equation is obtained by a modification of the Fredholm theory. This solution is developed to the point where only numerical substitutions are required to obtain the scattering amplitudes and differential cross sections for elastic nucleon-nucleon collisions, for any energy and any spins of the incident and scattered particles. (auth)

6553

QUANTUM THEORY OF SOLIDS. R. E. Peierls. London, Oxford Univ. Press, 1955. 229p.

The fundamental problems, known methods of solution, and unsolved basic problems are emphasized. The specific topics of discussion are general theory of and applications to crystal lattices, interaction of light with non-conducting crystals and with electrons in solids, electrons in a perfect lattice, cohesive forces in metals, transport phenomena, magnetic properties of metals, ferromagnetism, semiconductors and luminescence, and superconductivity. (B.J.H.)

TRACER APPLICATIONS

6554 NYO-3277

Connecticut. Univ., Storrs.

SECOND ANNUAL REPORT ON DISTRIBUTION STUDIES BETWEEN MELTS AND SOLID PHASES USING RADIO-ACTIVE TRACERS. Roland Ward, W. C. Orr, John Looby, and J. J. Casey. May 31, 1953. 34p. Contract AT(30-1)-1154.

Investigation of the system barium chloride-barium zirconate-cerium (III) chloride at 1000°C. under vacuum conditions has shown the formation of new cubic phases which have been tentatively identified as solid solutions of cerium (III) oxide in zirconia or of zirconia in cerium (III) oxide, which can be ignited in air to give solid solutions of zirconia and cerium (IV) oxide. The reaction is believed to occur according to the following equation: $2\text{CeCl}_3 + 3\text{BaZrO}_3 \rightarrow \text{Ce}_2\text{O}_3 + 3\text{ZrO}_2 + 3\text{BaCl}_2$. Phases of the same type are formed in the system barium oxide-zirconia-cerium (III) chloride-barium chloride, but not in the system zirconia-cerium (III) chloride-barium chloride. Preliminary investigation has been carried out on several systems involving other ternary oxides; of these, the system lanthanum cobalt oxide-yttrium chloride-barium chloride offers the most promise for ion distribution studies. It has been established, using radiobarium tracer, that there is only a very slow rate of exchange of barium ion between molten barium chloride and solid barium zirconate or titanate at 1000°C. (For preceding period see NYO-3277.) (auth)

URANIUM AND URANIUM COMPOUNDS

6555

AGES OF PITCHBLENDES BY X-RAY DIFFRACTION. B. Wasserstein (Geological Survey, Pretoria, England). Nature **176**, 159-60(1955) July 23.

A method is described for obtaining the ages of pitchblende by x-ray diffraction. Results give the age of α -uraninite as 520 million years and of β -uraninite as 420 million years. (B.J.H.)

6556

THERMAL NEUTRON-FISSION CROSS-SECTION OF URANIUM 233. Dragoslav Popovic and Einar Saeland (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). J. Nuclear Energy **1**, 286-9(1955) June.

The cross section was measured by irradiating a U^{233} sample in the thermal column of the JEEP reactor and determining the resulting number of fissions. The cross section was given as $\sigma_{\text{fiss}} = 492 \pm 25$ barns. (B.J.H.)

6557

STUDY OF THE FISSION CROSS SECTION OF U^{233} , U^{235} , AND Pu^{239} FOR SLOW NEUTRONS. J. M. Auclair, P. Hubert, and G. Vendryes. J. Nuclear Energy **1**, 306-10 (1955) June. (In French)

The fission cross-sections of U^{233} , U^{235} , Pu^{239} have been compared to the capture cross section of boron in the energy region about 0.01 to 2 ev. The resulting curves show resonances situated at 1.85 ± 0.15 ev for U^{233} , 0.29 ± 0.01 ev and 1.13 ± 0.03 ev for U^{235} , 0.03 ± 0.005 ev for Pu^{239} . (auth)

6558

THE THERMAL NEUTRON ABSORPTION CROSS-SECTIONS OF U^{238} AND Th^{232} . V. G. Small (Atomic Energy Research Establishment, Harwell, Berks, England). J. Nuclear Energy **1**, 319-20(1955) June.

A method of determination of thermal neutron absorption cross sections is described, and for U^{238} and Th^{232} , σ_{abs} were found to be 2.76 ± 0.06 and 7.57 ± 0.17 b, respectively. (B.J.H.)

6559

ABSORPTION OF URANYL IONS BY CLAYS. S. Goldsztaub and R. Wey. Bull. soc. franc. mineral. et crist. **78**, 242-8 (1955) Apr.-June. (In French)

This study has been undertaken on well defined clays. The chief results are the following: montmorillonite H and kaolinite H absorb the UO_2^{++} cations as a function of their exchange capacities; pH has a strong influence on this absorption; a strong absorption of the uranium descendants UX_1 and UX_2 has been verified; the quantities of uranyl fixed by the montmorillonite in these experiments do not modify either the X diagram or its behavior outside of inflation. (tr-auth)

6560

SPECTROGRAPHIC STUDY OF AN ARGENTINE URANIUM MINERAL (GUMMITE). Hellmuth Freimuth. Comuns. inst. nacl. invest. cienc. nat. anexo museo argentino cienc. nat. "Bernardino Rivadavia" Ser: Cienc. geol. **1**, No. 14, 1-12 (1955). (In Spanish)

Information is given on the existence of uranium minerals, principally gummite, in Argentina; the existence of this mineral in other countries is also indicated. The installation of the spectrographic laboratory of the Instituto Nacional de Investigación de las Ciencias Naturales y Museo is described, and a spectrographic analysis of a sample of Argentine gummite is presented. The chemical composition of gummite from Argentina and other countries is presented. (tr-auth)